

Nephrectomy caused by *Proteus mirabilis* in a patient without clinical signs of sepsis

Nefrectomia por *Proteus mirabilis* em paciente sem sinal de sepse



Alexandre Sacchetti Bezerra^{1*}

João Roberto Paladino Junior²

André Akira Ramos³

Murilo Crellis de Carvalho²

Alexandre Gomes Sibanto Simões²

¹Cirurgia Vascular, Faculdade de Medicina do ABC, São Paulo, SP, Brazil.

²Urologia, Faculdade de Medicina do ABC, São Paulo, SP, Brazil.

³Acadêmico, Faculdade de Medicina do ABC, São Paulo, SP, Brazil.



Submitted: 23 November 2021

Accepted: 13 December 2021

Published: 15 June 2022

*Corresponding author:

Alexandre Sacchetti Bezerra

E-mail: a.bezerr@uol.com.br/
dr.bezerra@einstein.br

ABSTRACT

A 40-year-old female patient presented with pain in her abdomen for 3 days, not associated with urinary symptoms. There was a history of renal lithiasis without treatment 6 years ago. Physical examination did not show signs of sepsis, while computed tomography showed renal destruction. Nephrectomy was performed with *Proteus mirabilis* grown in culture. It has been known that this bacterium is associated to struvite stones, which can cause pyonephrosis. Unfortunately, the patient lost her kidney due to lack of adequate treatment.

Headings: Nephrolithiasis; *Proteus mirabilis*; Pyonephrosis.

RESUMO

Mulher de 40 anos apresentava dor abdominal há 3 dias sem associação com sintomas urinários. Havia história de litíase renal não tratada há 6 anos. Ao exame físico não apresentava sinais de sepse, enquanto a tomografia computadorizada denotava destruição renal. Realizada nefrectomia com presença de *Proteus mirabilis* na cultura. Sabe-se que esta bactéria está associada à formação de cálculo de estruvita, podendo causar pionefrose. Infelizmente a paciente perdeu o rim devido a tratamento inadequado.

Descritores: Nefrolitíase; *Proteus mirabilis*; Pionefrose.

INTRODUCTION

Proteus mirabilis (PM) is a facultative anaerobic, Gram-negative bacterium of the *Enterobacteriaceae* family that is frequently associated with urinary tract infections^{1,2}.

In addition to synthesizing virulence factors such as hemolysin, PM produces urease that hydrolyzes urea to ammonia and carbon dioxide^{2,3}. In the presence of hydrogen, ammonia is converted into ammonium, thereby increasing the pH level of the urine. This alkalization leads to phosphate and magnesium precipitation and the formation of struvite stones^{1,3}. Such lithiasis results in a vicious cycle of increased bacterial proliferation, and consequently, increased urea and ammonium synthesis, urine alkalization, and struvite precipitation^{2,4}.

Struvite formation without adequate medical intervention generates an obstruction in the genitourinary tract, culminating in pyelonephritis^{1,5}.

CASE DESCRIPTION

A 40-year-old, single, female post-graduate student presented to our department with severe abdominal pain associated with decreased stool clearance for three days.

DOI: 10.5935/2764-734X.e202112005

The patient reported a history of renal colic associated with recurrent infections that started six years ago, but she has been in remission for two years already. During her follow-up session in the Department of Nephrology and Urology, a percutaneous nephrolithotripsy was scheduled; however, this was not performed due to covid-19 pandemic quarantine restrictions. There was no recent fever, decreased urine output, dysuria, and other urinary symptoms. She also denied tobacco smoking, alcohol drinking and had not undergone any previous surgeries.

Upon physical examination, she was afebrile, with a heart rate of 84 bpm and blood pressure of 140 × 90 mmHg. She also had a palpable tumor of approximately 30 × 20 cm on the right side, rebound tenderness, negative Giordano test, and a normal digital rectal examination.

The laboratory tests conducted at admission are outlined in Table 1.

Table 1. Laboratory tests conducted at admission.

	PATIENT	REFERENCE VALUES
URINE		
Leukocytes	> 1.000.000/ml	0-10.000/mL
Nitrites	Positivo	Negative
Red blood cells	578	0-8.000/mL
Appearance	Purulent	Yellow
EXAMES SÉRICOS		
C-reactive protein	25,3	Under 1mg/dL
Sodium	134	137-145 mmol/L
Potassium	4,4	3,5-5,1 mmol/L
Urea	27	15-36 mg/dL
Creatinine	0,8	0,53-1 mg/dL
Hemoglobin	10,3	12-16 g/dL
Hematocrit	30,7%	36-46%
Serum leukocytes	14.600	4.500-11.000/uL
Serum neutrophils	83,9% (12.249)	45,5-73,3% (1.600-7.700/uL)

Contrast-enhanced computed tomography of the abdomen showed significant pyelocaliceal dilatation of the right kidney and the presence of kidney stones (Figures 1 and 2), leading to the diagnosis of pyonephrosis.

It was decided that a right subcapsular nephrectomy, with calyx draining, should be performed. During the surgery, a large amount of pus was found in the pyelocaliceal system. After removing the kidney (Figures 3 and 4), the urinary tract was reviewed for possible residual stones. Independent samples of kidney stone, kidney tissue, and pus were sent for culture and antibiogram (Table 2).

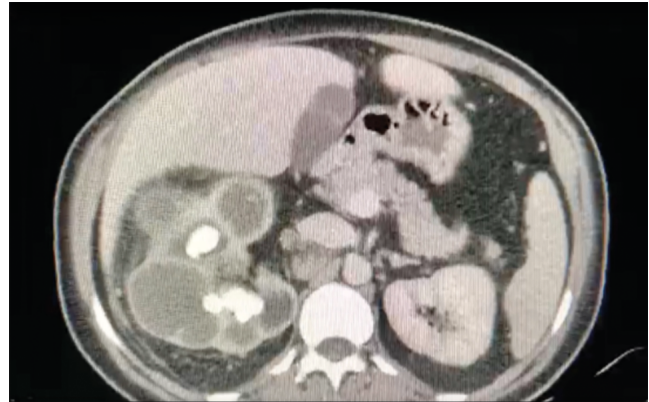


Figure 1. A large kidney stone on the renal pelvis.



Figure 2. Marked right kidney dilation with loculations indicative of pyonephrosis.

Postoperatively, the patient was clinically stable, afebrile, with clear diuresis, and no renal function deterioration. She was thus discharged from the hospital on the third postoperative day with instructions to continue taking 500 mg of cefuroxime every 12 hours.

DISCUSSION

Pyonephrosis is a urological emergency resulting from an infectious suppurative process during hydronephrosis. This causes renal parenchyma distortion or destruction, with possible loss of renal function. Pyonephrosis is usually associated with severe health impairment, including symptoms such as fever, chills, low back pain, and abdominal pain upon palpation^{2,6-9}.

Ultrasonography is a diagnostic method that is quite accurate and non-invasive. In this method, the lower portion of the dilated collecting system generates weak echoes and fluid levels. Excretory urography may be used to demonstrate hydronephrosis in non-functioning or severely compromised kidneys^{7,10,11}. Computed tomography also helps in visualizing stones and identifying the degree of impairment of the renal parenchyma^{8,11,12}.

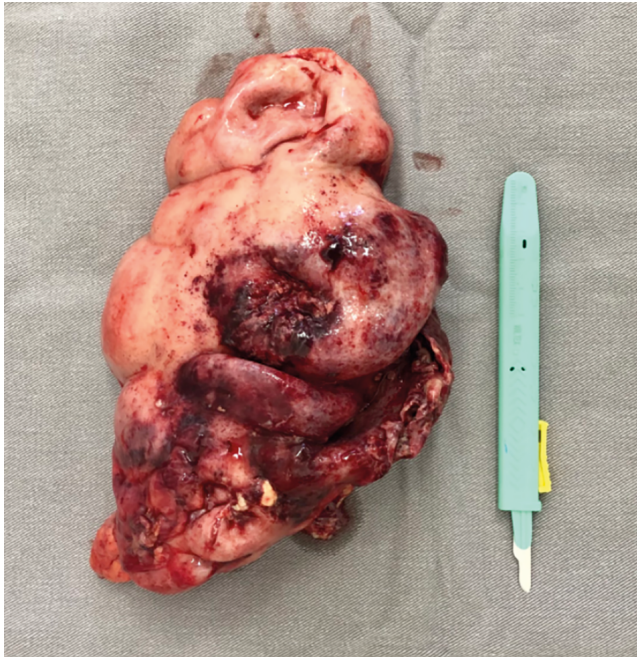


Figure 3. Right kidney (2.16 kg / 34.6 × 21.8 cm) showing pyonephrosis.

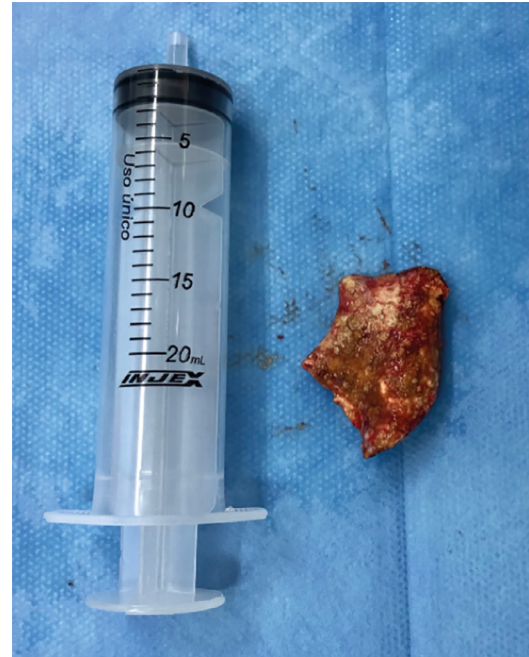


Figure 4. Struvite kidney stone measuring 6.4 × 5.8 cm.

Table 2. Laboratory results of cultures and antibiograms.

SAMPLE	BACTERIUM	SENSITIVITY	MIC (Minimum Inhibitory Concentration)	ANTIMICROBIAL RESISTANCE
Kidney stone	<i>Proteus mirabilis</i>	Amikacin	≤8	-
		Piperacilin/Tazobactam	≤8	
		Ampicillin	≤4	
		Aztreonam	≤1	
		Ceftazidime	≤1	
		Cefotaxime	≤1	
		Ciprofloxacin	≤0,06	
		Cefepime	≤0,5	
		Cefuroxime	≤4	
		Gentamicin	≤2	
		Levofloxacin	≤0,5	
		Meropenem sulfamethoxazole/ trimethoprim	≤0,12	
		Tobramycin	≤2/38	
		Fosfomicin	≤16	
Renal parenchyma	Negative	-	-	-
Calyceal pus	<i>Staphylococcus capitis</i>	Linezolid	≤1	Clindamycin
		sulfamethoxazole / trimethoprim	≤2/38	Ciprofloxacin
		Teicoplanin	≤1	Erythromycin
		Vancomycin	1	Gentamicin
		Daptomycin	≤1	Levofloxacin
		Fosfomicin	≤32	Oxacillin

It is common for patients with pyonephrosis to have a history of kidney stones and urinary tract infection that may be associated with the complete obstruction of the ureter^{7,8}. The probability of having ureteral obstruction is exponentially greater in patients with stones larger than 5 mm and is almost certain with stones larger than 10 mm. It is thus important to consider whether the patient has a history of large stones^{7,8,10}.

Pyonephrosis and urinary stasis brought about by ureteral obstruction predispose the patient to maintain and perpetuate a repetitive cycle of infection, which is worsened by the delay in treatment^{2,8,9}. Even without a preventive solution through vaccination against PM¹², patients with renal lithiasis should be monitored and treated carefully to avoid elevated levels of urease that may result in sepsis and kidney failure⁶.

Severe pyelonephritis is usually accompanied by thrombocytopenia, anemia, increased levels of transaminase, urea, and creatinine, resulting in acute renal failure. However, these were not observed in this patient, which may have contributed to the delay in diagnosis and treatment^{7,8,10,13}.

Treatment is done by draining the infected renal pelvis and using broad-spectrum empirical antibiotic therapy. Percutaneous drainage is as effective as conventional surgery for the treatment of large and medium-sized renal abscesses. Pyonephrosis due to renal lithiasis can also be addressed by ureteroscopy^{7,8,10,14,15,16}.

Delaying treatment may result in sepsis and a poor prognosis for renal viability, which may leave the patient with no other option but to undergo a nephrectomy^{6,8,9,14,15}. In this case report, a nephrectomy was recommended due to total renal parenchyma destruction.

Histopathological examination of the resected kidney showed various degrees of renal parenchyma destruction, as well as dilatation of the pelvis and renal calyces. The increase in pressure resulting from the accumulation of purulent material further aggravated changes in the anatomical structure of the organ^{2,4,7}.

Despite the long history of infection, the patient recovered satisfactorily after the kidney resection without serious complications such as septic shock, splenic abscess, psoas abscess, peritonitis due to rupture of the purulent collection, and renocolic fistulas^{8,13}.

This case reports an atypical situation due to a nephrectomy performed in a patient with no general

health impairment and afebrile throughout her infectious condition. Thus, physicians must investigate lithiasis associated with PM and carefully look for stones larger than 5 mm in women with recurrent urinary tract infections^{7,8,10}.

"This case report deserved an official declaration of acknowledgement and ethical approval by its institution of origin and was peer-reviewed before publication, whilst the authors declare no fundings nor any conflicts of interest concerning this paper. It is noteworthy that case reports provide a valuable learning resource for the scientific community but should not be used in isolation to guide diagnostic or treatment choices in practical care or health policies. This Open Access article is distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work and authorship are properly cited."

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