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ORIGINAL RESEARCH

Pyonephrosis: epidemiological, clinical, and therapeutic aspects at Aristide Le Dantec University Hospital Centre (Dakar)

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Introduction: Pyonephrosis is most often secondary to an obstruction in the urinary excretory tract. It is a serious condition that can be life-threatening due to septic shock as well as functionally life-threatening due to the destruction of the renal parenchyma. Our study aimed to analyse the epidemiological, clinical, and therapeutic aspects of pyonephrosis at the Urology Department of the Aristide Le Dantec University Hospital Centre (CHU).

Materials and methods: This was a retrospective study of 82 patients followed up for pyonephrosis in the Urology-Andrology Department of the Aristide Le Dantec CHU from 1 January 2005 to 31 December 2021. The parameters studied were the epidemiological, clinical, and therapeutic aspects of pyonephrosis.

Results: The annual incidence was 5.1 ± 3.4 patients. The mean age was 44 ± 15.6 years. The mean time to diagnosis was 24.5 ± 8.7 months. Lower back pain and low-grade fever were the symptoms at presentation, with respective percentages of 87.2 % and 69.8%. Fever and lower back pain were the most frequent signs identified in clinical examination, with percentages of 64.6% and 65.8%, respectively. *Escherichia coli* and *Klebsiella pneumoniae* were the most frequent germs detected by cytobacteriological examination of urine (CBEU). *Pseudomonas aeruginosa* and *Bacteroides spp.* were the most frequent germs found in the cytobacteriological examination of pus. Uro-tomodensitometry (Uro-CT), performed in 57.3% of patients (*n* = 47), led to a diagnosis of pyonephrosis in 89.3% of patients (*n* = 42). Urinary lithiasis was the main cause of renal parenchymal destruction. Nephrectomy was performed in 70.7% of patients (*n* = 58). It was preceded by nephrostomy in 52.4% of cases (*n* = 43), coupled with bi-antibiotherapy. Extracapsular nephrectomy was the most common procedure, accounting for 84.5% (*n* = 49). Intraoperative events were noted in 25 patients. Peritoneal and pleural injuries predominated. Conservative treatment was instituted in 26.8% of patients. The average hospital stay was 7.3 ± 10.2 days. The global rate of complications was 4.87% and mortality was 3.65%.

Conclusion: The long consultation time means that the main treatment modality remains nephrostomy followed by nephrectomy or nephrectomy from the outset, and does not often allow conservative treatment.

Keywords: pyonephrosis, nephrostomy, nephrectomy, Senegal

Introduction

Pyonephrosis is defined as the presence of a purulent collection in the renal cavities associated with significant perinephritis secondary to partial or total destruction of the renal parenchyma by an infectious process, most commonly secondary to an obstruction in the urinary tract.[1,2] This obstruction is often a stone. Pyonephrosis has become increasingly rare in developed countries but remains common in countries where access to healthcare remains difficult.[3] The prevalence of this condition can rightly be considered as an indicator of the health status of a country. Our study aimed to analyse the epidemiological, clinical, and therapeutic aspects of pyonephrosis at the Urology Department of the Aristide Le Dantec CHU.

Materials and methods

This was a retrospective descriptive study of 82 patients followed up for pyonephrosis at the Urology-Andrology Department of the Aristide Le Dantec CHU from 1 January 2005 to 31 December 2021. All patients with pyonephrosis with a complete medical record were included, regardless of age or sex. The parameters analysed were:

- epidemiological aspects (incidence, age, and sex);
- clinical aspects (circumstances of detection, time to consultation, length of hospital stay, side affected, personal history, and clinical examination data); and
- therapeutic aspects.

Data was collected from consultation, surgery, and hospitalisation registers and analysed using Microsoft Excel software.

Results

The annual incidence was 5.1 ± 3.4 patients. The mean age was 44 ± 15.6 years. The distribution of patients according to age is shown in Figure 1.

The 30–39 age group was predominant (*n* = 30) with a sex ratio of 0.86. Lower back pain and fever were the most common presenting symptoms with percentages of 87.2% and 69.8%, respectively (Figure 2). The distribution of patients according to the circumstances of presentation is shown in Figure 2. Pyeloplasty was the most common surgical procedure in which a diagnosis was made (*n* = 10).

The mean time to diagnosis was 24.5 ± 8.7 months. The left side was involved in the majority of cases (65.8%). However, one patient had bilateral involvement and underwent bilateral nephrostomy

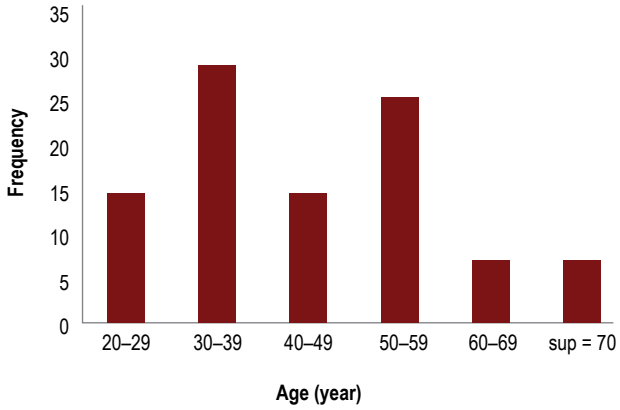

Figure 1: Distribution of patients according to age

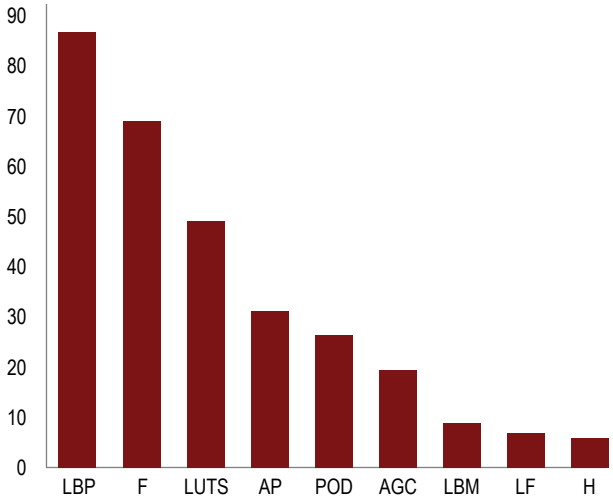

Figure 2: Distribution of cases according to circumstances of discovery
LBP – lower back pain; F – fever, LUTS – lower urinary tract symptoms, AP – abdominal pain, POD – intra-operative discovery, AGC – altered general condition, LBM – lower back mass, LF – lumbar fistula, H – haematuria

drainage followed by left nephrectomy. Medical history was recorded in 19.6% of patients. Chronic kidney deficiency (CKD) and recurrent urinary tract infections were the most common past medical conditions (5% each). A history of urological surgery was noted in 15% of patients (n = 12). Previous surgery for urinary lithiasis was noted in 10% of patients (n = 8), mainly nephrolithotomy. Fever and lumbar pain were the most common clinical findings in 64.6% and 65.8%, respectively. Table I shows the different clinical manifestations observed.

Table I: Distribution of patients according to the results of additional examinations

Clinical manifestations observed	*n*	%
Lumbar pain	54	**65.8**
Large kidney	25	30.4
Ureteral points sensitivity	43	52.4
Lumbar fistulas	4	4.8
Altered general condition	37	45.1
Fever	53	**64.6**

Renal function was impaired in five patients. CBEU results were reported in 42 patients. Urine was sterile in 32% of those patients. *Escherichia coli* and *Klebsiella pneumoniae* were the most common organisms. Data from the CBEU is shown in Figure 3.

Cytobacteriological results of pus samples were reported in 13 patients. *Pseudomonas aeruginosa* and *Bacteroides spp.* were the most common organisms accounting for more than 50% of cases. Ultrasound in 62.1% of patients (n = 51) was in favour of pyonephrosis in 68.08% of patients, with a collection of suspensions in the renal cavities and destruction of the renal parenchyma. Uro-computed tomography (UCT), performed in 57.3% of patients (n = 47), suggested the diagnosis of pyonephrosis in 89.3% of patients (n = 42). Urinary lithiasis was the most common cause of pyonephrosis. Renal scintigraphy was performed in 7.3% of patients (n = 6) and showed a non-functioning kidney in all of these patients. Nephrectomy was performed in 70.7% of patients (n = 58). In 52.4% of cases (n = 43), nephrostomy was preceded by antibiotic therapy with a combination of a third-generation cephalosporin or a fluoroquinolone and an aminoglycoside. Extracapsular nephrectomy

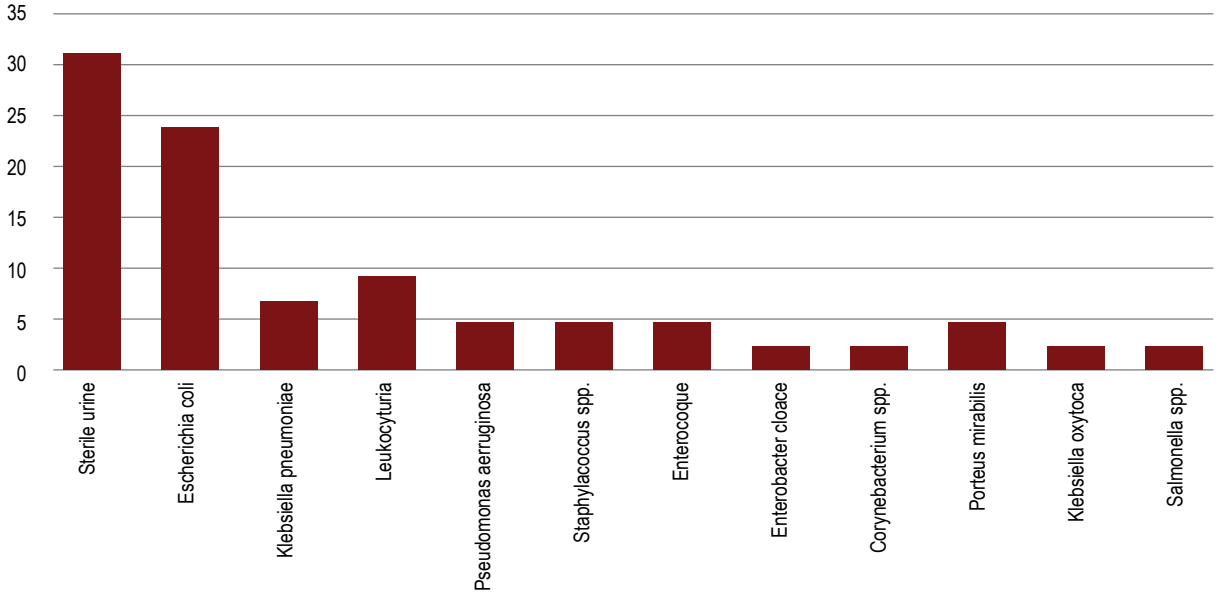

Figure 3: Distribution of CBEU results

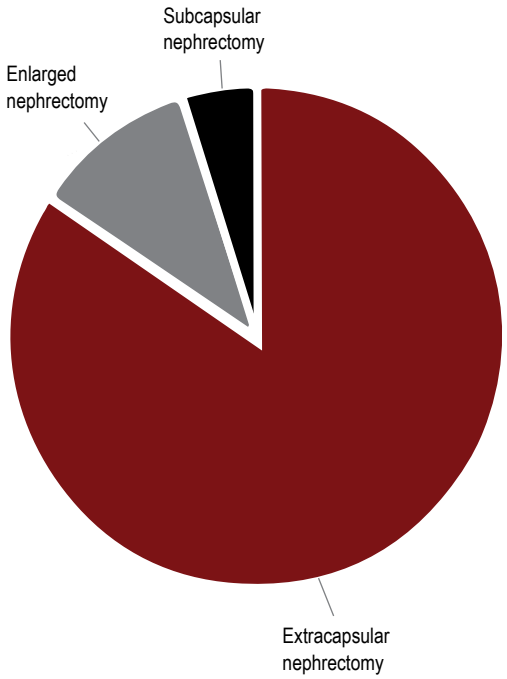

Figure 4: Distribution of the different types of nephrectomy performed

was the most common procedure, accounting for 84.5% (*n* = 49). The distribution of the type of nephrectomy is shown in Figure 4.

Intraoperative complications were noted in 25 patients. Peritoneal and pleural injuries were predominant. The distribution of the different types of injuries is shown in Table II.

Table II: Distribution of cases according to intraoperative incidents

Type of intraoperative incidents	*n*
Peritoneal rupture	14
Pleural rupture	8
Colon perforation	1
Intercostal artery lesion	1
Aortic injury	1
Total	25

Urinary lithiasis and pyeloureteral junction syndrome were the predominant causes, accounting for 38% (*n* = 21) and 33% (*n* = 18), respectively. Table III shows the different causes of pyonephrosis observed.

Table III: Distribution of cases by cause

Causes	*n*	%
Urinary lithiasis	27	32.92
Pyeloureteral junction syndrome	19	23.17
Repetitive urinary infections	4	4.87
Urogenital tuberculosis	4	4.87
Kidney cysts	3	3.65
Others	25	30.48
Total	82	100

Conservative treatment was given to 26.8% of patients, which consisted of repairing the anomaly caused by the pyonephrosis. The other subgroup included pyonephrosis caused by:

- textiloma (*n* = 1);
- invasion of the ureteral orifice by prostate adenocarcinoma (*n* = 1);
- ureteral stenosis (n=1)
- ureteral bifidity (*n* = 1); and
- undetermined causes (*n* = 21).

The mean length of hospital stay was 7.3 days. Overall morbidity was 4.87%. Complications included parietal suppuration in one patient, renal compartment abscess in one patient, and eventration in two patients. These complications were managed with local care, drainage combined with antibiotic therapy, and surgical cure, respectively.

Mortality was 3.65% (*n* = 3). There was one case of death on the operating table, which prevented nephrectomy. The cause of death was related to an anaesthetic problem. Acute generalised peritonitis with multiple digestive lesions (transverse colon, duodenum) resulted in the death of one patient four days postoperatively. Another patient died of septic shock after drainage.

Discussion

Pyonephrosis is a rare condition and its incidence remains low or non-existent in certain developed countries. However, it is still common in developing countries.[4] The incidence of pyonephrosis is considered an indicator of the general health status of a country. Limited or difficult access to health care for a country's population may increase the incidence of this condition.

The mean age in our series was 44 ± 15.6 years. The same trend was reported in the series of Ouggane et al.,[4] Cissé et al.,[5] and Diallo et al.[6] The mean ages in these series were 44, 46, and 49 years, respectively. The sex ratio in our series was 0.86. Our results were similar to those of Mosbah et al.[7] and Ondongo et al.[8] who reported a sex ratio of 0.8 and 0.77, respectively.

In our series, the number of cases of pyonephrosis per year was 5.1 ± 3.4. This was the same finding in many series published in other developing countries like ours. Diallo et al.[6] and Mosbah et al.[7] reported 1.9 and 5.1 cases per year with a length of study of 10 and 4 years, respectively. The mean consultation time in our series was 24.52 ± 16.05 months. This long delay in consultation can be explained by the fact that pyonephrosis often has an insidious onset. Pyonephrosis can sometimes be overlooked and diagnosed only at the stage of complications with the occurrence of renocutaneous or renocolic fistulas.[9] Sometimes the diagnosis is made after diffuse peritonitis due to the rupture of a pyonephrotic kidney; M'Bida et al.[10] report one case separately in the literature.

Lower back pain was the most common finding in our series, accounting for 87.2% of cases. This finding corresponds to that of Ouggane et al.[4] where this symptom was also the most common, with percentages of 100%, 90.6%, and 94%, respectively. Conversely, in the series by Mosbah et al.,[7] back pain and general deterioration were the main circumstances of detection. In our series, fever and lower back pain were the most common clinical findings, with percentages of 64.6% and 65.8%, respectively. This

trend was similar to the series of Diallo et al.,[6] where fever and back pain accounted for 100% and 63.2%, respectively.

In our series, the left side was the most commonly affected (65.8%), whereas Sow et al.[11] reported a predominance of the right side. Bilateral involvement was observed in one patient in our series. This patient had prostatic adenocarcinoma with bilateral invasion of the ureteral orifice. Bilateral drainage by nephrostomy was performed followed by left nephrectomy.

Certain antecedents favoured urinary tract infections and the development of pyonephrosis. These were either factors that led to immunodeficiency (diabetes, pregnancy, renal failure) or factors that favoured urinary stasis in the urinary tract (prostate tumour, ureteral stenosis).[12] These factors were also used as criteria for the severity of urinary tract infections. A history of urological surgery, particularly lithiasis, was noted in 9.7% of patients (*n* = 8). In contrast, Diallo et al.[6] reported a history of urinary lithiasis in 31.6% of their series.

Renal function was impaired in five patients in our series. In contrast, in the series by Ondongo et al.[8] and Sow et al.,[11] renal function was normal in all patients. This difference may relate to the underlying diseases of our patients (obstructive renal failure, HIV-related immunosuppression, etc.). CBEU was performed in 51.2% of patients (*n* = 42). Gram-negative *Enterobacteriaceae* (*Escherichia coli* and *Klebsiella pneumoniae*) were the most common. Our results are similar to those reported by Ondongo et al.[8] and Masfiyah et al.[13]

In our series, *Pseudomonas aeruginosa* and *Bacteroides spp*. were the most common bacteria found in pus samples. There was no concordance between the bacteria isolated from pus and those isolated from urine in the same patients. Ultrasound of the urinary tract was performed in 62.1% of patients (*n* = 51) and led to the suspicion of pyonephrosis in 68% of patients (*n* = 35) in our series. Lezin et al.[14] reported an estimated diagnostic contribution of 25% in their series. This difference could be explained by the fact that ultrasound is an operator-dependent examination. The sensitivity and specificity of ultrasound in the diagnosis of pyonephrosis are 38% and 96%, respectively, according to Wu et al.[15]

Uro-CT is currently the imaging modality of choice for the diagnosis of pyonephrosis and the detection of the underlying disease.[16] It was performed in 57.3% of patients (*n* = 47) and allowed the diagnosis of pyonephrosis in 89.3% of patients, as well as the determination of the cause in our series. Renal scintigraphy was performed in 7.3% of cases (*n* = 6) in our series. This result may be explained by the accessibility (low socioeconomic status of the patients) and availability of this imaging technique, as well as the fact that some cases were discovered intraoperatively. This technique is of secondary interest in assessing the residual functional value of the kidney after drainage.

The prognosis of pyonephrosis is improved by the use of septic urine drainage, especially nephrostomy. In the past, diagnosis required immediate nephrectomy.[17] This was associated with a high mortality rate. Therefore, the current trend in pyonephrosis is to perform a nephrostomy first, combined with antibiotic therapy.[18,19]

Some authors suggest performing a nephrostomy for upgrading antibiotic's efficiency before nephrectomy.[20] Drainage is indicated because the obstruction in the urinary tract causes congestion of infected urine and reduces the filtration capacity of the kidney. As a result, medical treatment is ineffective because it is impossible to achieve a urinary concentration of antibiotics. Consequently, more than anywhere else, urine drainage is a life-saving measure in this case. In this regard, Watson et al.[21] report the benefits of drainage by:

- facilitating the diffusion of antibiotics into the renal parenchyma;
- a reduction in the bacterial load due to the removal of pus and necrotic material; and
- a reduction in the pressure in the excretory cavities, leading to an immediate increase in perfusion and renal function.

Nephrostomy was considered by some authors to be the most effective method of urinary drainage in this context.[22] In addition to drainage benefits, nephrostomy has other therapeutic advantages such as in situ alkalinisation for uric acid lithiasis,[21-23] endopyelotomy for pyeloureteral junction syndrome, and dilatation and anterograde stenting for ureteral stenosis.[5-24]

In our series, 81.7% of cases (*n* = 67) were drained by nephrostomy alone. This can be performed under local anaesthesia and has the advantage of being less expensive. However, it can be associated with complications such as vascular wounds, gastrointestinal fistulas, and pleural lesions.[24,25] In our series, one complication was associated with nephrostomy. This was an acute generalised peritonitis with multiple digestive perforations, which led to the patient's death on the fourth day postoperatively.

Nephrectomy was performed in 70.7% of cases (*n* = 58) in our series. Subcapsular nephrectomy was the most common type of nephrectomy with a rate of 84.5% (*n* = 49). In our series, nephrectomy was preceded by a holding nephrostomy in 52.4% of cases (*n* = 43), whereas in the series by Diallo et al.,[6] nephrectomy was performed in all patients and was preceded by a nephrostomy in 57.8% of cases (*n* = 11).

Intraoperative complications were observed in 25 patients, with a predominance of peritoneal and pleural lesions in our series. In the series by Cissé et al.,[5] major bleeding due to detachment of the fibrous ganglia was the most common operative event. This situation is explained by the fact that nephrectomy for pyonephrosis is a difficult operation because of the perirenal inflammatory phenomena. Conservative therapy is an alternative to nephrectomy when the viability of the kidney is certain. Conservative therapy was performed in 26.8% of our patients (*n* = 22).

In the series of Ondongo et al.,[8] it was recommended in one case after normalisation of renal function two weeks after nephrostomy. Urinary lithiasis and pyeloureteral junction syndrome were the most common causes of pyonephrosis in our series. The same trend was reported by other authors.[6,8,17] However, rarer causes of pyonephrosis have been implicated, particularly tumours of the upper urinary tract.[10,24] Patients with pyonephrosis should be systematically screened for genitourinary tumours; their detection

preoperatively will change the therapeutic approach.[25] We also noted pyonephrosis secondary to a textiloma in a case who had undergone pyeloplasty four months previously in our series. Varga et al.[26] reported the same observation in a patient who had undergone pyeloplasty 36 years previously.

Mortality in our series was 3.6%. Mortality was lower in Harrison et al.[20] (2% of cases) and higher in Sow et al.[11] (9.1% of cases). This situation could be explained by the fact that Sow et al.[11] had a higher number of deaths from sepsis (4/44) relating to the delay in diagnosis. In general, the course of pyonephrosis is favourable and death from pyonephrosis has become rare since the advent of antibiotics and improved management.[8]

Conclusion

Pyonephrosis is a serious condition still seen in our practice despite advances in medical imaging for the diagnosis and management of underlying conditions. Due to the long delay in presentation, the main treatment modality remains nephrostomy followed by nephrectomy or nephrectomy from the outset. Conservative treatment is often not approved.

Conflict of interest

The authors declare no conflict of interest.

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Ethical approval

The various professors of magisterial rank at the Urology-Andrology Department of the Aristide Le Dantec CHU met and approved the relevant ethical considerations of research in this study.

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