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► **To cite this version:**

S. Gauthier, P. Tattevin, L. Soulat, J. Bouget, S. Abergel, et al.. Pain intensity and imaging at the initial phase of acute pyelonephritis. *Médecine et Maladies Infectieuses*, 2020, 50 (6), pp.507 - 514. 10.1016/j.medmal.2019.07.013 . hal-03491442

HAL Id: hal-03491442

<https://hal.science/hal-03491442v1>

Submitted on 9 Mar 2022

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Intensité de la douleur et imagerie à la phase initiale d'une pyélonéphrite aiguë

Pain intensity and imaging at the initial phase of acute pyelonephritis

Sarah Gauthier¹, Pierre Tattevin², Louis Soulat¹, Jacques Bouget¹, Sandra Abergel¹, Juliette Hascoet³, Romain Mathieu³, Luc Beuzit⁴, Didier Myhie⁵, Mathieu Revest², Karim Bensalah³,
Benoit Peyronnet³

1 : Service d'accueil des urgences, Université de Rennes 1, 35000 Rennes, France

2 : Service de maladies infectieuses, Université de Rennes 1, 35000 Rennes, France

3 : Service d'urologie, Université de Rennes 1, 35000 Rennes, France

4 : Service de radiologie, Université de Rennes 1, 35000 Rennes, France

5 : Département de médecine générale, Université de Rennes 1, 35000 Rennes, France

Corresponding author

Sarah Gauthier

Service d'Accueil des Urgences

Hôpital Pontchaillou, 2 rue Henri Le Guilloux

35000 RENNES

Email address: gauthiersarah21@gmail.com

Mots clés : imagerie, échographie, scanner, pyélonéphrite, douleur

Keywords: imaging, ultrasound, CT scan, pyelonephritis, pain

Résumé

Objectif. Rechercher l'existence de facteurs prédictifs de complication urologique à l'imagerie en cas de pyélonéphrite aiguë de la femme de 18-65 ans.

Méthode. Nous avons réalisé une étude monocentrique, observationnelle et rétrospective. Les patientes consultant dans un service d'urgences entre 2010 et 2015 pour une pyélonéphrite aiguë ont été incluses. Le critère d'exclusion était l'absence d'imagerie des voies urinaires aux urgences. Le critère de jugement principal était la présence d'une complication urologique à l'imagerie. Le critère de jugement secondaire était la modification thérapeutique après diagnostic par imagerie.

Résultats. 193 patientes ont été incluses : 88 (45,6 %) présentaient une complication urologique à l'imagerie. En analyse multivariée dans cette cohorte globale, l'antécédent de calcul urinaire (OR=2,41 ; $p=0,01$) et le caractère morphino-requérant de la douleur (OR=5,29 ; $p=0,009$) étaient associés à la découverte d'une complication urologique à l'imagerie. Parmi les 120 patientes avec pyélonéphrite simple ayant eu une imagerie, 45 % avaient une complication urologique, avec modification de la prise en charge thérapeutique chez 36,7 % d'entre elles. En analyse multivariée, l'âge > 40 ans (OR=4,58 ; $p=0,02$) et le caractère morphino-requérant de la douleur (OR=3,78 ; $p=0,02$) étaient significativement associés à la découverte d'une complication urologique à l'imagerie et à une modification de la prise en charge (OR=6,76 ; $p=0,005$ et OR=4,19 ; $p=0,01$ respectivement).

Conclusion. Le caractère morphino-requérant de la douleur, l'âge et l'antécédent de calcul des voies urinaires étaient associés au risque de complication urologique à l'imagerie chez les patientes atteintes d'une pyélonéphrite aiguë.

Abstract

Objective. To identify predictive factors of urological complication on imaging findings in women with pyelonephritis aged 18 to 65 years.

Methods. We performed an observational, retrospective, single-center study. The medical charts of women diagnosed with pyelonephritis at the emergency department from 2010 to 2015 were reviewed. Only patients who underwent an imaging study at the emergency department and with microbiologically confirmed pyelonephritis were included for analysis. The primary endpoint was the presence of urological complications on imaging findings. The secondary endpoint was treatment changes after imaging diagnosis.

Results. Of the 193 women enrolled, 88 (45.6%) had urological complication(s) on imaging findings. The multivariate analysis revealed that history of urolithiasis (OR=2.41; $p=0.01$) and pain requiring morphine use (OR=5.29; $p=0.009$) were predictive of urological complications on imaging findings. Of the 120 women with uncomplicated pyelonephritis who underwent imaging studies, 45% had urological complication, resulting in a treatment change in 36.7% of patients. The multivariate analysis revealed that age >40 years (OR=4.58; $p=0.02$) and pain requiring morphine use (OR=3.78; $p=0.02$) were predictive of urological complication(s) on imaging findings and of treatment change based on imaging findings (OR=6.76; $p=0.005$ and OR=4.19; $p=0.01$ respectively) in this subgroup.

Conclusions. Pain requiring morphine use, age, and history of urolithiasis are independent predictors of urological complications on imaging findings in patients with acute pyelonephritis.

Introduction

Urinary tract infection (UTI) is one of the most common disease in primary care. It is the second cause of antibiotic prescription in France [1] and worldwide [2]. UTI is more prevalent in women because of the female genitourinary anatomy [3], with up to one-third of sexually active women affected [4]. Pyelonephritis is an upper urinary tract infection, with clinical presentation involving fever and sometimes lower back pain and lower urinary tract symptoms.

There are two types of complicated UTIs: severe pyelonephritis with sepsis signs and obstructive pyelonephritis [5-6]. Imaging (computed tomography [CT] scan or ultrasound) aimed at ruling out a complicated presentation of UTI, is recommended by urological societies during the diagnostic evaluation of all pyelonephritis patients [7, 8]. Conversely, some primary care societies only recommend imaging study in selected cases such as lack of improvement after treatment or relapse [9].

The 2015 French multidisciplinary guidelines only recommend an imaging study – preferentially an ultrasound – in case of “pyelonephritis with hyperalgesia” [5]. While the idea makes sense, there is currently no data in the scientific literature to support this statement. Some studies suggest an association between clinical criteria (fever, duration of symptoms, flank pain, comorbidities), biological criteria (inflammatory syndrome), and renal abscess, which could encourage their use to select patients requiring initial imaging study [10-16]. Other studies did not report any risk factor for renal abscess, with authors pleading for systematic initial imaging to detect complications [17, 18].

The aim of this study was to assess predictive factors of urological complication on imaging findings (obstruction in the urinary tract, abscess) in women aged 18 to 65 years diagnosed with pyelonephritis in the emergency department.

Patients and methods

Study design

We conducted a single center retrospective chart review in the Hospital of Rennes, France. The medical records of all women aged 18 to 65 years who presented at the emergency

department for acute pyelonephritis between January 2010 and January 2015 were analyzed.

Inclusion criteria were: female gender, age between 18 and 65 years, final diagnosis of acute pyelonephritis. The exclusion criterion was the absence of imaging study performed in the emergency department (ultrasound, enhanced or unenhanced CT scan, or urinary tract CT scan).

We obtained the list of patients from the French hospital discharge database (French acronym PMSI), using the following ICD 10 codes: N10 (acute tubulointerstitial nephritis), N11.0 (nonobstructive reflux-associated chronic pyelonephritis), N11.1 (pyelonephritis with reflux), N11.8 (chronic obstructive pyelonephritis), N11.9 (other chronic tubulointerstitial nephritis), N12 (tubulointerstitial nephritis, unspecified), N13.6 (pyonephrosis), O23.0 (infections of kidney in pregnancy), and N13.9 (pyonephrosis). We also queried our emergency department software (Réurgences[®]) looking for medical records with the ICD 10 code N10 as a final diagnosis (acute tubulointerstitial nephritis).

The following data was extracted from the charts and then entered in a digital spreadsheet: age, comorbidities, history of urolithiasis, history of urinary tract abnormality, history of urological procedures, neurogenic lower urinary tract dysfunction, and clinical signs. Other data was included such as clinical data (spontaneous pain and localization, flank pain at palpation, fever and highest temperature, chills, vomiting, macroscopic or microscopic hematuria, urinary signs, deterioration of general status, loss of consciousness, other general signs, pain intensity according to a visual analogue scale from 1 to 10, duration of symptoms), blood tests (CRP level [mg/L], leukocyte level and platelet count [Giga/L], creatinine level [$\mu\text{mol/L}$]), type of imaging study (unenhanced or contrast-enhanced CT scan, ultrasound), microbiological findings (results of blood cultures and cytobacteriological testing of urine), type of antibiotics used and duration, and infection outcomes (pain requiring morphine use, septic shock, use of catecholamines, hospitalization and duration, recurrence of urinary infection).

Uncomplicated pyelonephritis was defined as per the French infectious diseases society's (French acronym SPILF) guidelines [5] as pyelonephritis in women aged <65 years, without

ongoing pregnancy, without anatomical abnormality of the urinary tract, without immunodeficiency, and without severe chronic kidney disease.

Protocol for the management of pyelonephritis in the emergency department over the study period

A standardized protocol was used for all pyelonephritis cases diagnosed over the study period, with an initial clinical evaluation (abdominal pain, flank pain, lower urinary tract symptoms, and other signs). Biological assessment was performed (creatinine, urea, blood count, CRP). A urine dipstick test and a urine culture were also performed. Blood cultures were performed in case of sepsis signs. The urologist's advice was sought if patients had a history of urological disorder or in case of complicated presentations of pyelonephritis. No stringent protocol was implemented regarding the use of morphine, which was left at the physician's discretion. An imaging study was performed in the emergency department when the SPILF's criteria for uncomplicated pyelonephritis were not met, or in case of persistent symptoms despite antibiotic treatment, or at the physician's discretion. Outpatient imaging study was always prescribed to patients who did not undergo an imaging study in the emergency department. Patients were admitted to hospital if they had a complicated presentation of pyelonephritis, if they required intravenous treatment, or if they had abscess or comorbidities. The antibiotic treatment was chosen as per the SPILF's guidelines [5].

The type of imaging study was chosen according to clinical signs and symptoms after discussion between the emergency physician and the on-call radiologist [19, 20]. Evaluation of the upper urinary tract by ultrasound was preferred in young women to avoid radiations, allowing to easily diagnose hydronephrosis and pyonephrosis. However, this imaging technique heavily depends on the radiologist's skills and is poorly reliable in overweight patients. Additional CT scan was performed when no diagnosis could be made by ultrasound. CT scan is irradiating but more accurate, especially to detect urinary stones. The choice to perform unenhanced or contrast-enhanced CT scan was left at the physician/radiologist's discretion.

The primary endpoint was the identification of one or more of the following urological complication(s) on imaging findings: stones in the urinary tract, hydronephrosis, and renal abscess. The secondary endpoint was a treatment change after imaging diagnosis.

Statistical analyses

Statistical analyses were performed using the JMP v.12.0[®] software (SAS Institute Inc, Cary, NC, USA). Continuous quantitative variables were expressed as means and standard deviations, and qualitative variables as numbers and percentages. Quantitative variables were compared with Fisher's exact test or the chi-square test, and continuous quantitative variables were compared using the Mann-Whitney test. Predictive factors of urological complication on imaging findings and of imaging findings leading to treatment changes were looked for with univariate and multivariate logistic regression analyses. Only covariates with $p < 0.2$ were included in the multivariate model. When significant statistical association was observed between a continuous variable and the primary endpoint, these variables were dichotomized around the median to identify an "at risk" cut-off. Statistical significance was set at $p < 0.05$.

Results

Characteristics of patients

A total of 193 patients were included for analysis as 46 patients were excluded because they did not undergo imaging study in the emergency department (Figure 1). The mean age was 37.7 years (± 14.5), 26.9% of patients ($n=52$) had a history of urolithiasis, 19.2% ($n=37$) had a history of urinary tract abnormality, 10.4% ($n=20$) had a neurogenic bladder, 7.3% ($n=14$) underwent kidney transplantation, and 6.7% ($n=13$) had diabetes (Table 1). The mean pain intensity according to a visual analogue scale (VAS) was 5.8/10 (± 2.9), 82.9% ($n=159$) had fever $>38.5^{\circ}\text{C}$, and the mean time since symptom onset was 3.5 days (± 3.9). The mean C-reactive protein level was 136.9 mg/L (± 110.8) and the mean serum creatinine level was 143.4 $\mu\text{mol/L}$ (± 120.6).

All 193 patients underwent imaging study: renal ultrasound for 37% ($n=71$), contrast-enhanced CT scan with excretory urography for 27.5% ($n=53$), unenhanced CT scan for 20.8% ($n=40$), and contrast-enhanced CT scan without excretory urography for 14.6% ($n=28$).

Urological complication(s) on imaging findings and impact on the patient's management

Eighty-eight (n=45, 6%) of the 193 patients had a urological complication on imaging findings (Table 2): 10 patients had renal abscesses (5.2%), 42 patients had a stone in the upper urinary tract ipsilateral to the flank pain (21.8%), 10 patients had another cause of obstruction in the upper urinary tract (5.2%), and 26 patients had hydronephrosis ipsilateral to the flank pain (13.5%).

Treatment was changed based on imaging findings in 68 patients (35.2%), with a surgical treatment (emergency or planned surgery) for 62 patients (32.1%); 58 patients had emergency urinary diversion (30.1%) (including nine patients with nephrostomy tube and 49 patients with a double-J ureteral stent), three patients (1.6%) had a longer duration of antibiotic therapy, two patients (1%) had a follow-up imaging study scheduled, two patients (1%) had diagnostic ureteroscopy, three patients (1.6%) had another specialized management (drainage of digestive abscess, gynecological procedure, etc.).

Seventy-one patients (36.8%) underwent renal ultrasound and 122 patients (63.2%) CT scan. Patients who underwent CT scan were more often diagnosed with urological complications than those who underwent ultrasound (56.2% versus 26.8%, $p<0.001$). Treatment changes (39.7% vs 26.8%, $p=0.004$), pyelonephritis signs on imaging findings (66.9% vs 30.3%, $p<0.001$), and incidental differential diagnoses (31.4% vs 10.1%, $p=0.005$) were more frequently associated with patients who underwent CT scans.

Differential diagnosis was observed on imaging findings for 45 patients (23.3%): eight patients (4.1%) had a renal mass (cyst, tumor, etc.), four patients (2.1%) had a gynecological abnormality, 14 patients (7.3%) had a congenital abnormality of the urinary tract, and one patient (0.6%) had emphysematous pyelonephritis and other various diagnoses.

Predictive factors of urological complications on imaging findings

The univariate analysis revealed that age (OR=4.09, $p=0.004$), history of urolithiasis (OR=3.85, $p<0.001$), CRP level at the time of hospital admission (OR=6.94, $p=0.02$), and pain requiring morphine use (OR=3.15, $p=0.01$) were associated with urological complications on imaging findings (Table 3).

The multivariate analysis revealed that history of urolithiasis (OR=2.41, $p=0.01$) and pain requiring morphine use (OR=5.29, $p=0.009$) remained the only two variables significantly associated with urological complications on imaging findings.

The univariate analysis revealed that age (OR=2.82, $p=0.04$), pain requiring morphine use (OR=3.40, $p=0.007$), and history of urolithiasis (OR=2.63, $p=0.004$) were significantly associated with treatment change based on imaging findings. Pain requiring morphine use (OR=6.35, $p=0.002$) remained the only significant predictor of treatment change based on imaging findings in the multivariate analysis.

Analysis in the uncomplicated pyelonephritis subgroup

A total of 154 patients had uncomplicated pyelonephritis, of whom 120 patients had an imaging study performed in the emergency department and were included in the study (Figure 2). Characteristics of these patients are detailed in Table 4.

A urological complication was diagnosed on imaging findings in 54 patients (45%): renal abscess in seven patients (5.8%), hydronephrosis in 37 patients (30.8%), a stone in the upper urinary tract ipsilateral to the flank pain for 33 patients (27.5%), and another cause of upper urinary tract obstruction in seven patients (5.8%). Treatment was changed based on imaging findings in 44 patients (36.7% of the subgroup of uncomplicated pyelonephritis patients).

The univariate analysis revealed that age (OR=4.82, $p=0.01$), history of urolithiasis (OR=2.80, $p=0.02$), systemic symptoms (OR=2.17, $p=0.048$), and pain requiring morphine use (OR=3.19, $p=0.04$) were significantly associated with urological complication on imaging findings. The multivariate analysis revealed that age (OR=4.58, $p=0.02$), and pain requiring morphine use (OR=3.78, $p=0.02$) were still significantly associated with urological complication on imaging findings (Table 5).

The univariate analysis revealed that age (OR=4.87, $p=0.01$), pain requiring morphine use (OR=3.53, $p=0.02$), and history of urolithiasis (OR=2.51, $p=0.04$) were significantly associated with treatment change based on imaging findings. Age (OR=6.76, $p=0.005$) and pain requiring morphine use (OR=4.19, $p=0.01$) remained the only statistically significant predictors of treatment change based on imaging findings in the multivariate analysis.

The percentage of urological complications on imaging findings observed in patients with pain requiring morphine use was 69%, and 62.5% of patients underwent treatment change based on the imaging findings (Figure 3).

The percentage of urological complications based on imaging findings in patients aged ≥ 40 years was 57.7%, and 46.2% of these patients had a treatment change (Figure 4).

The percentage of urological complications based on imaging findings in patients with a history of urolithiasis was 64.3%, and 53.6% of these patients had a treatment change (Figure 5).

Discussion

Our study identified three predictive factors of urological complication on imaging findings in women aged 18-65 years presenting with pyelonephritis: history of urolithiasis, pain requiring morphine use, and age (linear association between urological complications on imaging findings).

To our knowledge our study is the first to report the association between pain intensity and the risk of urological complication on imaging findings. However, other predictive factors of urinary tract obstruction have already been reported: inflammation on blood test, fever intensity [10], or low blood pressure [11]. Only the SPILF's guidelines [5] mention the need for imaging studies in case of hyperalgesia in patients with acute pyelonephritis, but they do not clearly define hyperalgesia. We did not observe any association between pain intensity as assessed by VAS and the risk of urological complication, but we observed a significant association with pain requiring morphine use. Hence our work could be regarded as a post-hoc validation of the SPILF's guidelines statement regarding the need for immediate imaging studies in this population with pain requiring morphine use. Our findings also evidenced the lack of association between pain intensity as assessed by VAS and morphine prescription in our emergency department.

In our study, as in previous series [19, 21, 22], urological complications were more frequently diagnosed by CT scan than ultrasound. This might be due to a selection bias because patients with severe presentations of pyelonephritis could be more likely to have a CT scan than an ultrasound; we were thus more likely to detect complications. However, the better sensitivity of the CT scan in detecting urinary complications of pyelonephritis has already been reported in literature. The impact of radiations on young women should be accounted for when choosing the imaging modality as well as the risk of allergy to gadolinium contrast agent [20]. The use of first-line CT scan should thus be restricted to specific patients: severe clinical presentation, additional imaging study when the ultrasound does not provide a diagnosis.

Initial assessment of patients by ultrasound in the emergency department has been increasingly used over the past decade [23, 24]. Initially used for multiple traumatic injuries (Focused Assessment with Sonography for Trauma, FAST), the ultrasound is now used in many other indications. According to the recent French emergency society guidelines, emergency physicians should “be able to diagnose hydronephrosis by ultrasound” [25]. Little data is available in the literature [12], but initial ultrasound performed in the emergency department in patients presenting with acute pyelonephritis could contribute to identifying patients requiring further imaging study by radiologists (either CT scan or ultrasound). Using FAST ultrasound might minimize the risk of missing urological complications during the initial assessment and may improve the cost-effectiveness of these patients’ management [26].

We observed an association between a history of urolithiasis and a risk of urological complications on imaging findings. To our knowledge this variable has rarely been investigated as a potential risk factor for urological complications [5, 7]. Risk factors for complications are indeed usually limited to “abnormalities of the urinary tract”, without past history of urolithiasis. The statistical association we demonstrated might be explained by the high risk of recurrence of urolithiasis (up to 50% at 5 years) [27, 28]. Similar to previous series [12-15, 29], our findings emphasize the importance of this criterion. It should therefore be included in the decision-making process to select patients for initial imaging assessment.

Our study has several limitations, such as its retrospective and single-center design. Moreover, the relatively small sample size and inherent lack of statistical power might explain the lack of statistical significance for some variables (e.g., systemic symptoms). Inclusions were made based on our local information system with ICD 10 codes allowing us to only identify patients with a final diagnosis of pyelonephritis. It would have been relevant to include in our analysis all patients with a clinical presentation compatible with pyelonephritis, to assess the role of imaging study in detecting differential diagnoses. As the choice of imaging study may impact diagnosis, one may think that complications were not diagnosed in patients who underwent ultrasonography versus those who had a CT scan performed. There was also a selection bias as selecting patients in the emergency department does not properly reflect the population of patients consulting in primary care settings. Patients included in our study and those consulting in community settings probably do not share the same characteristics, especially as some of our patients had been referred

to the emergency department by their family physician. This selection bias could explain the similar rates of complications on imaging findings in patients presenting with uncomplicated pyelonephritis and in the whole cohort (all pyelonephritis cases). Hence, no conclusion could be drawn from our work on the management of patients in a primary care setting.

Conclusion

Pain intensity as assessed by visual analogue scale was not associated with the risk of urological complications on imaging findings or with treatment change based on imaging findings, either in the whole cohort (including pyelonephritis at high risk of complications) or in the selected population of patients without comorbidities. However, pain requiring morphine use was significantly associated with a risk of urological complications on imaging findings, which supports the role of initial imaging study in patients presenting with such clinical signs and symptoms. Age and history of urolithiasis highly increased the likelihood of urological complications on imaging findings. These clinical criteria could help detect good candidates for initial imaging study among patients with uncomplicated pyelonephritis. Nevertheless, the high rate (45%) of urological complications on imaging findings in patients with uncomplicated pyelonephritis consulting at the emergency department would argue in favor of systematic initial imaging study in these patients.

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Figure 1. Flow chart – acute pyelonephritis

Figure 1. Organigramme – pyélonéphrite aiguë

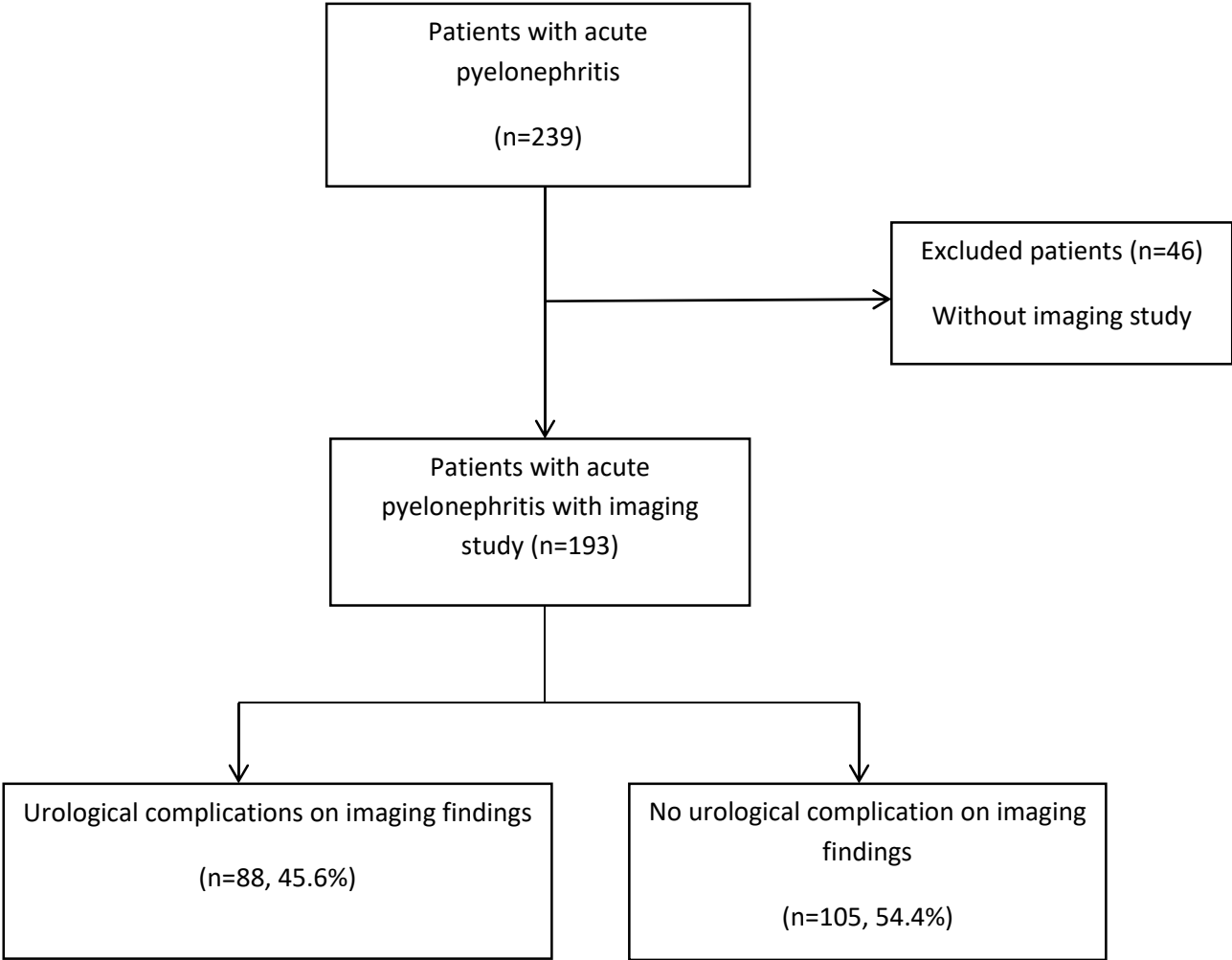


Figure 2. Flow chart – uncomplicated pyelonephritis

Figure 2. Organigramme – pyélonéphrite simple

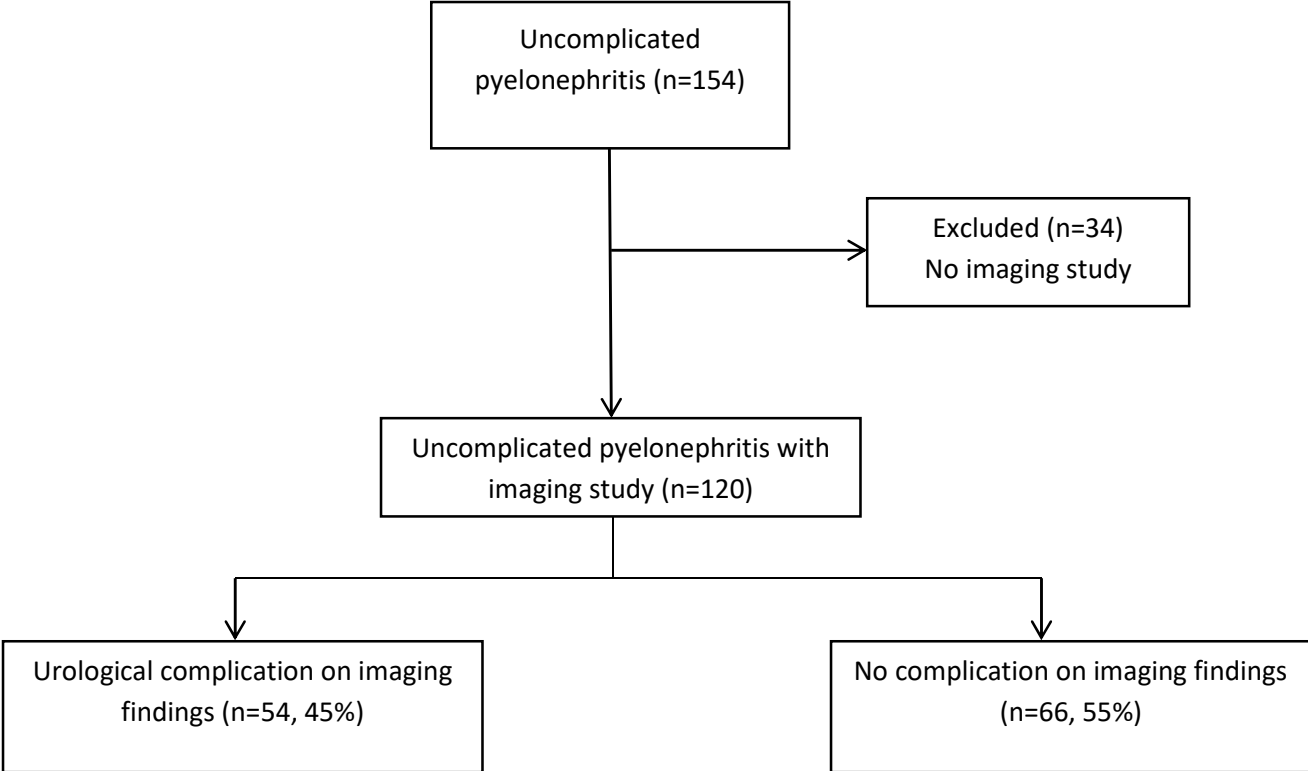


Figure 3. Urological complications and treatment changes depending on the morphine-requiring characteristic of pain

Figure 3. Complications urologiques et modifications du traitement selon le caractère morphino-requérant ou non de la douleur

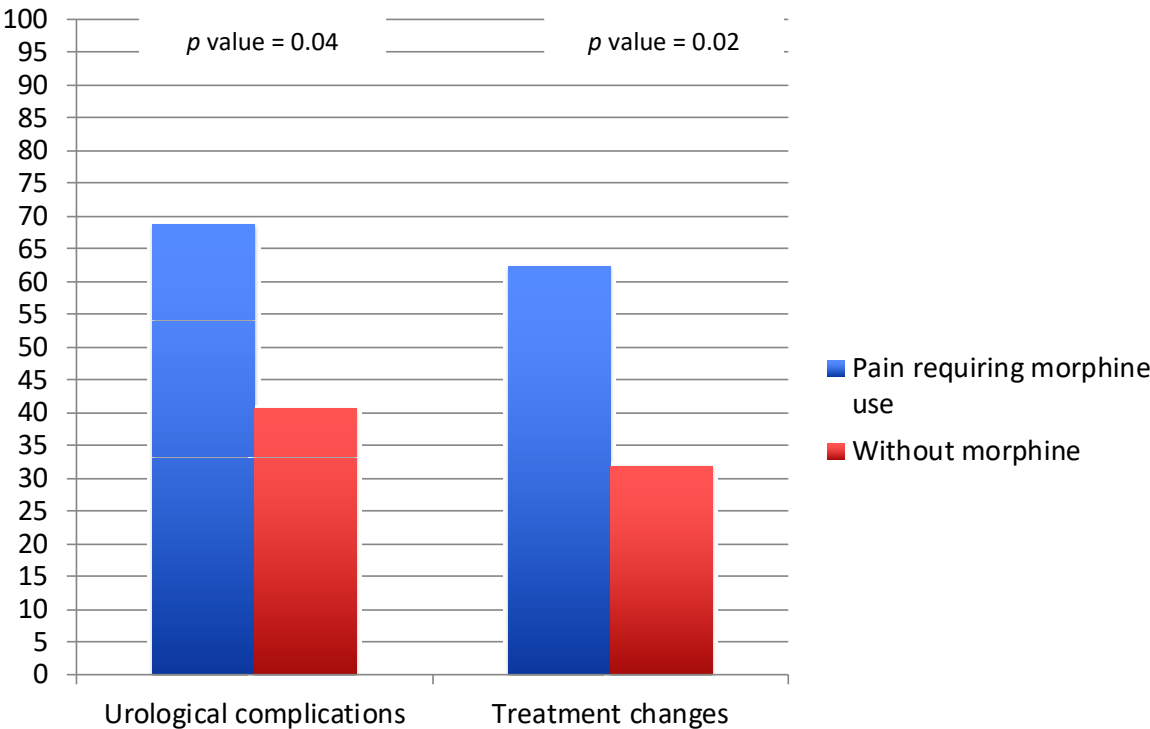


Figure 4. Urological complications and treatment changes by age

Figure 4. Complications urologiques et modifications du traitement selon l'âge

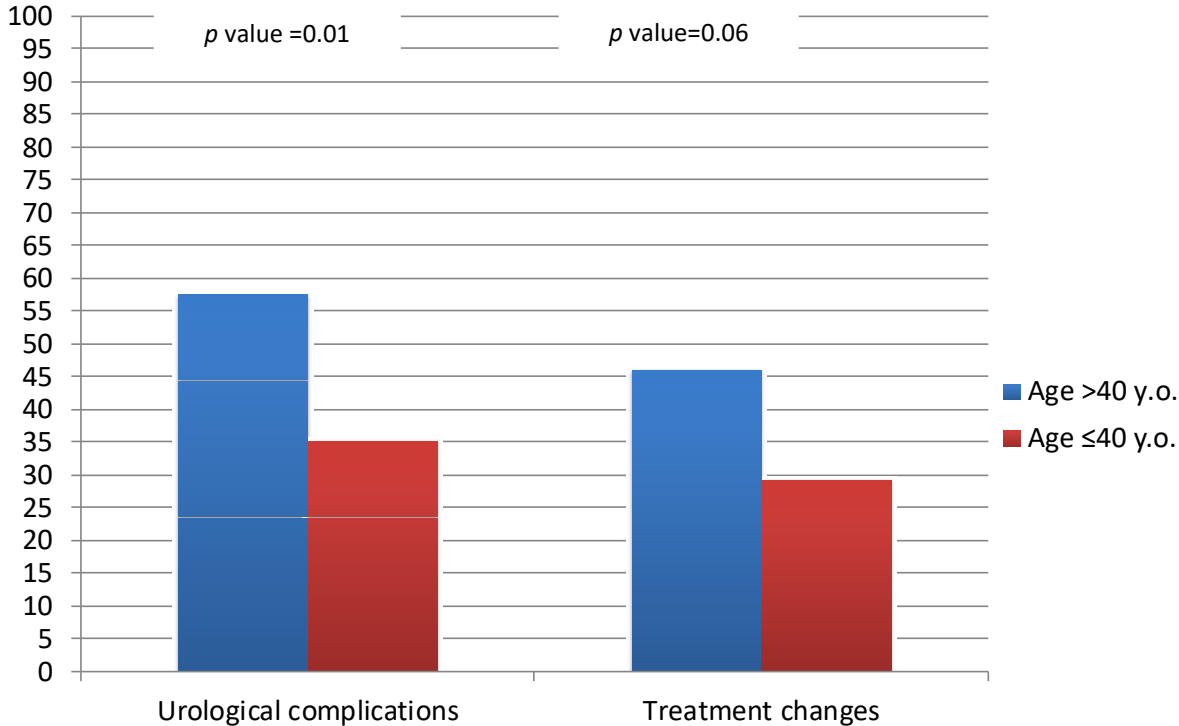


Figure 5. Complications urologiques et modifications du traitement selon l'existence ou non d'un antécédent de calcul urinaire

Figure 5. Urological complication and treatment changes according to a past history of urolithiasis

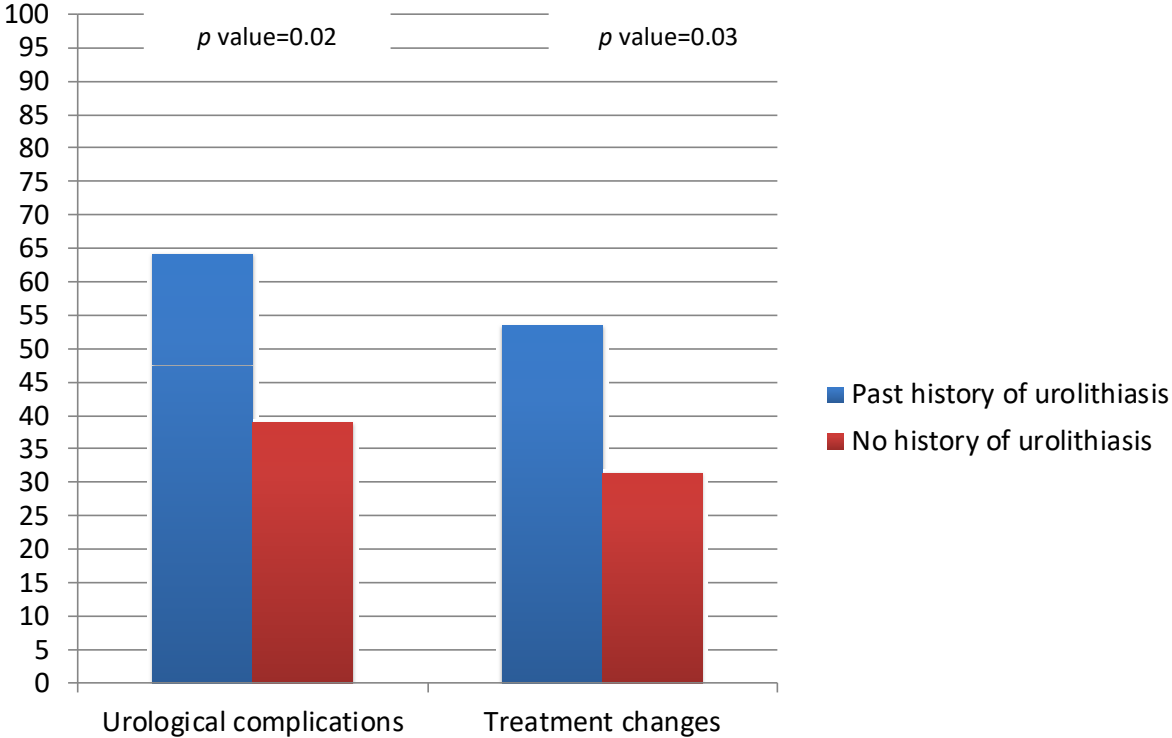


Table 1. Characteristics of patients**Tableau 1.** Caractéristiques des patientes

	Characteristics of patients N=193
Mean age (years)	37.7 (\pm 14.5)
Comorbidities and history of urological disorders	
Diabetes	13 (6.7%)
Kidney transplantation	14 (7.3%)
Neurogenic bladder	20 (10.4%)
Urinary tract abnormality	37 (19.2%)
History of urolithiasis	52 (26.9%)
Fever >38.5°C	159 (82.8%)
Systemic symptoms (fainting, deterioration of general status, etc.)	60 (31.3%)
Pain intensity assessed by visual analogue scale (/10)	5.8 (\pm 2.9)
Mean CRP level at admission (mg/l)	136.9 (\pm 110 .8)
Mean serum creatinine level at admission (μmol/l)	143.3 (\pm 120.6)

Mean time since symptom onset (days)	3.5 (\pm 3.9)
Imaging study	
Unenhanced CT scan	40 (20.8%)
Contrast-enhanced CT scan without excretory urography	28 (14.6%)
Contrast-enhanced CT scan with excretory urography	53 (27.5%)
Renal ultrasound	71 (37%)

CT: computed tomography

Table 2. Urological complications on imaging findings

Tableau 2. Complications à l'imagerie

Type of urological complications	Patients with imaging study n=193
Renal abscess	10
Stone in the upper urinary tract ipsilateral to the flank pain	42
Another cause of obstruction in the upper urinary tract (hematoma, tumor, fecaloma, etc.)	10
Hydronephrosis ipsilateral to the flank pain	26

Table 3. Prognostic factors of urological complication on imaging findings in univariate and multivariate analyses

Tableau 3. Facteurs prédictifs de complication urologique à l'imagerie en analyses univariées et multivariées

Variables	Urological complication on imaging findings							
	Univariate analysis				Multivariate analysis			
	Odds ratio	95% confidence interval		p value	Odds ratio	95% confidence interval		p value
		Lowest limit	Highest limit			Lowest limit	Highest limit	
Age	4.09	1.97	6.24	0.004*	2.53	0.86	4.32	0.19
Past history of urolithiasis	3.85	1.98	7.77	<0.001*	2.41	0.94	6.45	0.01*
Neurogenic bladder	0.62	0.22	1.57	0.31	-	-	-	-
Past history of upper urinary tract surgery	0.88	0.43	1.82	0.75	-	-	-	-
Diabetes	1.02	0.32	3.20	0.97	-	-	-	-
Systemic symptoms	1.76	0.96	3.29	0.07	1.79	0.75	4.34	0.19
CRP level at admission	6.94	1.72	9.89	0.02*	4.07	0.81	3.93	0.16
Pain requiring morphine use	3.15	1.28	8.58	0.01*	5.29	1.51	22.07	0.009*

Visual analogue scale								
Highest pain	1.17	0.29	2.46	0.77	-	-	-	-
Mean time since symptom onset	4.66	0.86	6.91	0.16	2.00	0.13	5.94	0.59

Tableau 4. Caractéristiques des patientes du sous-groupe pyélonéphrites simples sans signes de gravité

Table 4. Characteristics of patients included in the uncomplicated pyelonephritis, without severe signs, subgroup

	Characteristics of patients n=120
Mean age (years)	37.5 (\pm 1.3)
Past history of urolithiasis	28 (23.3%)
Fever >38.5°C	104 (86.7%)
Systemic symptoms	34 (28.7%)
Pain intensity with visual analogue scale (/10)	5.8 (\pm 0.3)
CRP level (mg/L)	130.2 (\pm 11.1)
Serum creatinine level (μmol/l)	109 (\pm 11.6)
Mean time since symptom onset (days)	3.5 (\pm 0.3)
Imaging study	
Unenhanced CT	24 (20.2%)
Contrast-enhanced CT with excretory urography	23 (19.3%)
Renal ultrasound	37 (31.9%)

Table 5. Prognostic factors of urological complications on imaging findings, in univariate and multivariate analyses in patients with uncomplicated pyelonephritis

Tableau 5. Facteurs prédictifs de complication urologique à l'imagerie en analyses univariées et multivariées chez les patients ayant un tableau de pyélonéphrite simple

Variables	Urological complications on imaging findings							
	Univariate analysis				Multivariate analysis			
	Odds ratio	95% confidence interval		p value	Odds ratio	95% confidence interval		p value
		Lowest limit	Highest limit			Lowest limit	Highest limit	
Age	4.82	2.61	6.57	0.01*	4.58	2.44	6.36	0.02*
Past history of urolithiasis	2.80	1.18	6.96	0.02*	2.42	0.95	6.48	0.06
Systemic symptoms	2.17	1.01	5.14	0.048*	2.34	0.97	5.83	0.06
CRP level	2.71	0.27	7.88	0.28	-	-	-	-
Pain requiring morphine use	3.19	1.08	10.76	0.04*	3.78	1.18	13.72	0.02*
Visual analogue pain Highest pain	1.01	0.25	3.91	0.99	-	-	-	-
Mean time since symptom onset	1.34	0.08	6.77	0.78	-	-	-	-