

Profile of Urinary Tract Infections in the Elderly in the Internal Medicine Department of the University Hospital Center of Point G, Bamako, Mali

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Abstract

Introduction: Urinary tract infections (UTI) are frequent and of polymorphous clinical symptomatology in elderly subjects both in and out of hospital. In Mali, to our knowledge, no study concerning UTIs in the elderly has been conducted, hence the interest in this innovative work. **Objectives:** To determine the prevalence and clinical and paraclinical aspects of urinary tract infections in the elderly. **Materials and Methods:** This was a prospective descriptive and cross-sectional study from September 1, 2013 to August 31, 2014, *i.e.* duration of 12 months. All patients aged 65 years and over, hospitalized or ambulatory in the internal medicine department with a documented urinary tract infection were included. **Results:** We collected and examined 194 patients. The cytobacteriological study of urine (CBSU) was positive in 28 patients, *i.e.* a prevalence of 14.43%. The male sex represented 59.8% of the cases, the sex ratio was equal to 1.46. The age groups between 65 - 69 and 70 - 74 years were the most affected, respectively 28.57% and 39.28%. The main clinical signs were: asthenia, anorexia, dependence, fever, urinary burning, dysuria. Hospitalization was associated with urinary tract infection with P =



0.01. The group of enterobacteria were incriminated in 75% of cases. *Escherichia coli*, *Klebsiella pneumoniae* and *Pseudomonas aeruginosa* represented 39.28%, 14.28% and 10.71% of cases. Urinary tract infections were represented by pyelonephritis, acute prostatitis, orchi-epididymitis and simple cystitis. **Conclusion:** Urinary tract infection is frequent in the elderly, its clinical presentation is polymorphic and enterobacteria are the most incriminated group of bacteria.

Keywords

Urinary Tract Infection, Elderly Subject, Internal Medicine, Point G Hospital, Mali

1. Introduction

Urinary tract infections (UTI) are frequent and of polymorphous clinical symptomatology in elderly subjects both in and out of hospital [1] [2] [3]. In the community, they rank second after bronchial and pulmonary infections [4] [5]. In the hospital setting, they rank first [3]. They are a public health problem both in terms of management and cost and are a daily problem [6]. They are the most frequently treated bacterial infections in the elderly in institutions [7]. In the city, the prevalence of urinary tract infections is estimated at 140/1000 in women over 75 years of age and at 50/1000 in men [8]. This difference in prevalence is historically explained by the greater distance between the urethral meatus and the anus in men, a drier environment at the urethral opening, a longer urethra and antibacterial activity of prostatic secretions [9].

In Tunisia, the prevalence of UTI in the Internal Medicine Department of Habib Thameur Hospital between January 2002 and December 2006 was 16.6%. It seems to be higher in elderly subjects than in those under 65 years of age with 35.2% and 17.9% respectively [2].

In Morocco, the prevalence rate of urinary tract infections at the Military Hospital Instruction Mohamed V in Rabat is 17.49%, *i.e.* 7.18% among outpatients and 10.31% among inpatients over 65 years of age [10].

In Mali, to our knowledge no study concerning UTI in the elderly specifically has been conducted hence the interest of this study.

The objectives of this study were to determine the prevalence and the clinical and paraclinical aspects of urinary tract infections in the elderly.

2. Materials and Methods

This was a prospective, descriptive, cross-sectional study from September 1, 2013 to August 31, 2014, *i.e.* duration of 12 months. Were included, all patients aged 65 years and over, hospitalized or outpatient in the department of Internal Medicine presenting a documented urinary tract infection.

For each patient, the interrogation allowed to note on an individual survey

form the following data:

- Functional complaints: alteration of the general state, fever, agitation, delirium and incoherent speech, constipation, diarrhea, vomiting, pollakiuria, polyuria, urinary incontinence, suprapubic and or lumbar pain.
- Physical signs: large kidneys (lumbar contact), suprapubic and lumbar pain, bladder globe, prostate hypertrophy—Complementary tests: CBC, ESR, CRP, blood glucose, creatinine, CBSU (cytological and bacteriological study of urine), uroculture, antibiotic susceptibility test, blood culture, abdomino-pelvic ultrasound, abdomino-pelvic scanner.
- History: Hypertension, Diabetes, HIV, surgery on the urinary tract: kidneys, ureters, prostate, bladder.

Operational definitions:

- Urinary tract infection: positive urine cytobacteriological examination associated with at least one of the following signs;
- Temperature $\geq 38.5^{\circ}\text{C}$ or hypothermia $\leq 36.5^{\circ}\text{C}$;
- Dysuria;
- Pollakiuria;
- Burning of the bladder;
- Suprapubic tension;
- Recent urinary incontinence;
- Drowsiness, onset or worsening of anorexia, disorientation, dependence.

The CBSU is said to be positive if:

* with no catheterization: leukocyturia > 105 CFU /ml with 1 or 2 species of bacteria on culture, * with round-trip catheterization: leukocyturia > 102 CFU /ml with 1 or more species of bacteria on culture [11].

- Urinary colonization or asymptomatic bacteriuria: this is the presence of a microorganism in the urine without associated clinical manifestations. There is no bacteriuria threshold, except in pregnant women, where a bacteriuria threshold of 105 CFU/ml is classically used.

Elderly patient: any person over 65 years of age, whether retired, able-bodied or disabled with at least 3 criteria of frailty or over 75 years of age [12] [13].

- Nosocomial urinary tract infections or hospital-acquired infections: urinary tract infections acquired during a hospital stay and which were neither present nor incubating at the time of the patient's admission. They occur more than 48 hours after admission and are usually considered nosocomial [14] [15].

Community-acquired urinary tract infections: urinary tract infections acquired in the city at a distance from any hospital or therapeutic stay. They manifest themselves in less than 48 hours after hospitalization.

- Recurrent cystitis: they are defined by the occurrence of at least 4 episodes during 12 consecutive months [13].
- Pyelonephritis: microbial inflammation of the pelvis associated with invasion of the interstitium by suppurative streaks. It can be primary (without urological lesions) or secondary (following a uropathy or an obstacle), acute or

chronic.

- Simple urinary tract infections: urinary tract infection (UTI) occurring in patients with no risk factors for complications [13].
- Severe urinary tract infections.

These are acute pyelonephritis and male UTI associated with:

- Severe sepsis;
- Septic shock;
- An indication for surgical or interventional drainage (risk of aggravation of sepsis in the perioperative period) [13].

Urinary tract infections at risk of complication: these are UTI occurring in patients with at least one risk factor that can make the infection more serious and the treatment more complex [13]. The risk factors for complication are:

- Any organic or functional abnormality of the urinary tree (bladder residue, reflux, lithiasis, tumor, recent procedure ...).
- Male gender, because of the frequency of underlying anatomical or functional anomalies.
- Pregnancy.
- Elderly subject: patient over 65 years old with >3 criteria of frailty (Fried criteria), or patient over 75 years old.
- Severe immunodepression.
- Severe chronic renal failure (clearance < 30 ml/min) [13].
- *Fried criteria:*
- Involuntary weight loss in the past year.
- Slow walking speed.
- Low stamina.
- Weakness/tiredness.
- Reduced physical activity [13].

Data entry and analysis were performed using Microsoft WORD 2007 and SPSS Software version 20.0. For the comparison of our proportions we used the Chi-square test with $p < 0.05$.

Informed consent was obtained from the patients included in our study. In case of major disability, the consent of the family was requested. The anonymity and confidentiality of the results were assured.

3. Results

We collected and examined 194 patients according to our inclusion criteria during the study period. The CBSU was positive in 28 patients, a prevalence of 14.43%. The male sex represented 59.8% of the cases, with a sex ratio of 1.46. The average age was 69 ± 2 years. The age groups between 65 - 69 and 70 - 74 years were the most affected, respectively 28.57% and 39.28%.

The main clinical signs were: physical asthenia, anorexia, dependence, fever, urinary burning, dysuria. They were more marked in hospital than in the outpatient setting (Cf. **Table 1**).

Hospitalization was associated with urinary tract infection with $p = 0.01$ (Cf. **Table 2**). It occurred in patients with the following comorbidities: HTA (10 cases), Liver cancer (5 cases) cirrhosis (7 cases), diabetes (7 cases) and heart failure (6 cases). Urinary tract infections were represented by pyelonephritis, acute prostatitis, orchi-epididymitis and simple cystitis. Trans-urethral urinary catheterization was associated with urinary tract infection with $p < 0.005$ (Cf. **Table 3**). Enterobacteriaceae was incriminated in 75% of cases. *Escherichia coli*, *Klebsiella pneumoniae* and *Pseudomonas aeruginosa* accounted for 39.28%, 14.28% and 10.71% of the cases (see **Table 4**). Of the 28 cases of confirmed UTIs, 22 were hospitalized with 14 males and 8 females, and *Escherichia coli* represented 41% of the germs found. In outpatient settings, urinary tract infection was more frequent in women (4 cases) with 33.3% of *E. Coli*. Trans-urethral urinary catheterization and *Escherichia coli* were respectively the most common factors for urinary tract infection (18 cases/28) and the most common germ isolated by cytobacteriological examination of urine (11 cases). Prostatic obstruction and diabetes were the other factors responsible for the frequent presence of *Escherichia Coli* in our study. All the germs found at the CBSU had in common the presence of a trans-urethral urinary catheter (Cf. **Table 5**).

Table 1. Distribution of 28 patients with urinary tract infection according to symptomatology and origin.

Symptoms	Outpatient	Hospitalization	Total
Pollakiuria	1	10	11
Burning of the bladder	3	12	15
Dysuria	2	10	12
Pelvic pain	0	9	9
Vomiting	2	12	14
Gross hematuria	0	1	1
Low back pain	1	5	6
Urinary incontinence	0	11	11
Fiver	3	13	16
Hypothermia	0	2	2
Thrill	2	8	10
Confusion	0	8	8
Fall	0	2	2
Anorexia	2	16	22
Asthenia	5	18	23
Karnofsky dependency < 45%.	1	17	18

Table 2. Distribution of patients according to their origin and urinary infections.

	Outpatient	Hospitalization	Total
Presence of UTI	6 (3.09%)	22 (11.34%)	28 (14.43%)
Absence of UTI	78 (40.21%)	88 (45.36%)	166 (85.57%)
Total	84 (43.30%)	110 (56.70%)	194 (100%)

p = 0.01.

Table 3. Distribution of patients according to the trans-urethral urinary catheter and urinary infection.

Urinary catheterization	Presence of UTI	Absence of UTI	Total
Presence of a survey	18 (9.28%)	10 (5.15%)	28 (14.43%)
Absence of survey	10 (5.15%)	156 (84.42%)	166 (85.57%)
Total	28 (14.43%)	166 (85.57%)	194 (100%)

p < 0.005.

Table 4. Distribution of bacteria responsible for infections according to their morphology and group.

Morphology	Groupe	Group frequency	Groupe %	Species	Group frequency	Species %
Gram negative bacilli	Enterobacteria	21	75%	<i>Escherichia coli</i>	11	39.28%
				<i>Klebsiella pneumoniae</i>	4	14.28%
				<i>Pseudomonas aeruginosa</i>	3	10.71%
				<i>Acinetobacter sp</i>	1	3.57%
				<i>Enterobacter cloacae</i>	1	3.57%
				<i>Proteus mirabilis</i>	1	3.57%
				<i>Streptococcus sp</i>	3	10.71%
Gram positive cocci	Streptococci	5	25%	<i>Streptococcus non groupable</i>	2	7.14%
	Staphylococci	1		<i>Staphylococcus à coagulas négatif</i>	1	3.57%
	Enterococci	1		<i>Enterococcus</i>	1	3.57%
Total		28	100%		28	100%

Table 5. Distribution of the 28 patients according to the factors favouring urinary tract infection and the germs isolated.

Bacteria	Diabetes	Urinary catheter	Prostate adenoma	Total
<i>Escherichia coli</i>	3	5	3	11
<i>Klebsiella pneumoniae</i>	1	3	0	4
<i>Pseudomonas aeruginosa</i>	1	2	0	3
<i>Streptococcus sp</i>	1	2	0	3
<i>Streptococcus non groupable</i>	0	2	0	2
<i>Acinetobacter sp</i>	0	2	0	1
<i>Proteus mirabilis</i>	0	1	0	1
<i>Staphylococcus à coagulase négatif</i>	0	1	0	1
<i>Enterococcus faecalis</i>	0	1	0	1
<i>Enterobacter cloacae</i>	1	1	0	1
Total	7	18	3	28

4. Discussion

Of the 276 patients seen during the study period, 194 met the inclusion criteria, of whom 28 CBSU were positive, *i.e.* a prevalence of 14.43%. This high prevalence of hospital-acquired UTIs in our series could be explained by the frequent recruitment of patients who had stayed in the emergency department and had been subject to repeated urinary catheterization. Besma Ben Dhaou Hmaidi in Tunisia, Maxwell in Morocco and Traoré in the nephrology department of the university hospital center of Point G reported respective prevalences of 16.6%, 17.49% and 15.6% [2] [10] [16]. The male sex represented 59.8% of the cases, with a sex ratio of 1.46. Our results are in agreement with those of Maxwell in Rabat who found a male predominance of 56.4%, with a sex ratio of 1.29 [10].

On the other hand, the male predominance was not found by some authors; in Tunisia, Besma Ben Dhaou Hmaidi *et al.* [2] reported a sex ratio F/H of 0.35; at the University Hospital of Montpellier [17], in the department of internal medicine and acute geriatric care, the proportion of male cases was 1.46 is 2 to 3 women for every man; and it was 2 women for every man in subjects over 65 years old in Paris [18]. The age groups between 65 - 69 and 70 - 74 years were the most affected, with 28.57% and 39.28% respectively. Maxwell found in his study a total of 56.4% with an equal frequency of 28.2% for the two age groups 65 - 70 years and 70 - 75 years [10]. The clinical symptoms were dominated by dependence (85%), asthenia (82.14%), anorexia (81.48%), fever (57.14%), urinary burning (53.57%), vomiting (50%), chills (35.71%), pollakiuria (39.28%), urinary incontinence (39.28%), lumbar and pelvic pain (32.14%). These signs highlight the polymorphism of symptoms encountered in the elderly during urinary tract infections, and the misleading aspect of certain symptoms. Several studies report the atypical nature of UTI symptoms in the elderly [1] [2] [3] [19] [20] [21] [22].

Hospitalization was associated with UTI with $p = 0.01$, but not with length of hospitalization ($p = 0.49$). This finding corroborates that reported in the literature [10] [20] [23].

The analysis of the history shows that UTI was more frequent in patients with the following pathologies: Hypertension (10 cases), Liver cancer (5 cases) cirrhosis (7 cases), diabetes (7 cases) and IC (6 cases). Concerning the antecedents or risk factors, we find ourselves in a polymorphic context with age and no factor is incriminated with certainty.

With advanced age, the elderly person accumulates functional fragility and numerous pathologies other than urological (diabetes, non-acquired immunodepression) which may favor urinary infection [14]. UTI are more frequent in inpatients 20% (22/110) than in outpatients 7.14% (6/84) $p = 0.01$. Maxwell found UTI rates in inpatients and outpatients to be 10.31% and 7.18% respectively [10].

In 2009, De Wazières reported that nosocomial urinary tract infection increases with advancing age as does bacteriuria, unlike community-acquired UTI

which are a frequent reason for consultation and medical prescription in routine practice [24]. In general, urinary tract infections seem to be more frequent in the elderly and in hospitals [2] [10]. Urinary tract infection was more frequent in patients with urinary catheters: 64.29% (18/28) than in those without catheters (6.02%), with a statistically significant difference ($p = 0.005$). Maxwell in Rabat found few urinary tract infections in subjects with urinary catheters. This is probably due to good compliance of the medical services with the recommendations for urinary catheterization [10]. Our study shows a frequency of urinary tract infections in hospitalized patients, but it is not related to the length of hospitalization ($p = 0.49$). This finding has been made by other authors [10] [20] [23].

As for the germs isolated, Gram-negative bacilli (GNB) were the most frequently identified in the culture media during our study, with *Escherichia coli*, *Klebsiella pneumoniae* and *Pseudomonas aeruginosa* in the lead. This has also been found in several international series [24] [25] [26]. From the review of the literature, it appears that BGN are frequently encountered in bacteriuria [2] [24]-[30].

Among the enterobacteria (gram bacille négatif) in our study, *Escherichia coli* was the most incriminated and isolated in 39.28% cases. In Tunisia in 2011, this bacterium was isolated in 58% of cases [2].

At the Mohamed V Military Hospital in Rabat in 2014, it was isolated in 59% of cases [10]. For our study *E. coli* was followed by *Klebsiella pneumoniae* 14.28% and *Pseudomonas aeruginosa* 10.71%, *Streptococcus sp* 10.71%, for the rest, we isolated 3.57% of *Acinobacter Sp*, *Proteus mirabilis* of coagulase-negative *Staphylococcus*, *Enterococcus faecalis* and *Enterobacter cloacae*.

In the literature, *E. coli* is the most incriminated in UTI [24]. According to the SPLIF 2014, *E. coli* is the most frequently encountered bacterium (70% - 95%) in community-acquired UTIs. It is followed by the other enterobacteria especially *Proteus sp.* and *Klebsiella sp* [13].

Faucher N and Cudenne T. in Paris found that *E. coli* is more frequent in elderly women in the community and in hospitals. On the other hand, in elderly men, *E. coli* is more frequent in the community; in the hospital, *Proteus mirabilis* is the most frequent [20] [31].

The frequency of *Pseudomonas aeruginosa*: 4.8% is similar to that found in a retrospective study of UTI at the Mohamed V Military Hospital in Rabat in 2013 [10].

For Gram-positive cocci in our study, we found the following proportions: 10.71% for *Streptococcus sp* and 3.57% for non-groupable *Streptococcus* and coagulase-negative *Staphylococcus*. Maxwell reported for Gram-positive cocci a frequency of: 4.8%, for *Enterococcus faecalis* and for group B *Streptococcus*, and 1.2% for coagulase-negative *Staphylococcus* was low [10]. The antibiotic susceptibility of the isolated germs was variable, thus *Escherichia coli* was resistant to amoxicillin (81.81%); to amoxicillin + clavulanic acid (45.45%). It was sensitive to ceftazidime (72.72%), cefoxitine (81.81%), imipenem (81.81%), amikacin

(90.90%), gentamicin (72.72%), ciprofloxacin (54.54%), nalidixic acid (45.45%), chloramphenicol (81.81%), sulphamethoxazole + trimethoprim (27.27%) and colistin (100%). Traoré *et al.* reported in a study in 2012 a sensitivity of *E. coli* to 89%; amikacin, colistin and doxycycline to 88.2% each [32]. According to Alami *et al.*, *E. coli* had a sensitivity rate of 99% for fosfomycin, colistin, amikacin, ceftazidime and imipenem [33]. The same author reports resistance rates of 76% for amoxicillin, 54% for amoxicillin + clavulanic acid, 46% for 1st generation cephalosporins (C1G), 34% for Ciprofloxacin, 19% for 3rd generation cephalosporins (C3G) and 14% for aminoglycosides. *E. coli* resistance to antibiotics has become an alarming problem in Morocco. This situation is the consequence of the selection pressure due to the massive prescription and the often abusive use of broad spectrum antibiotics, both in hospital and in community settings [33].

According to De Mouy *et al.*, the resistance rates of *E. coli* in community urinary tract infections were as follows: ampicillin (60.5%), amoxicillin + clavulanic acid (65.9%), gentamicin (98.8%), nalidixic acid (93.4%), norfloxacin (97%), ciprofloxacin (97%), fosfomycin (99.3%), and cotrimoxazole (77.4%) [34].

Comparing these rates with those of our work, we notice that our *E. coli* strains are more resistant to betalactam and also present a decreased sensitivity to gentamicin, nalidixic acid, ciprofloxacin and cotrimoxazole. Esparcia *et al.* in a European study reported *E. coli* strains with zero susceptibility to imipenem and 33.5% to sulfamethoxazole + Trimethoprim [35]. Here, we note that our *E. coli* species are more sensitive to colistin.

In France, in the elderly in 2013, the authors reported a sensitivity of *E. coli* to fosfomycin at 95% [36].

Klebsiella pneumoniae strains were sensitive to ceftazidime (75%), imipenem (66.66%), ceftazidime (75%), amikacin (75%), gentamicin (66.66%), chloramphenicol (75%) and colistin (100%).

For Maxwell *et al.* *Klebsiella pneumoniae* strains were sensitive to ceftazidime (76.92%), ertapenem (75%), imipenem (75%), ceftriaxone (64.29%) ceftazidime (64.29%), amikacin (93.33%), tobramycin (73.33%), gentamicin (66.67%), fosfomycin (93.33%), colistin and chloramphenicol (100%) [10].

Alami *et al.* reported for *Klebsiella pneumoniae*, a very high sensitivity rate for C3G and aminoglycosides (99%) and for piperacillin and amoxicillin + clavulanic acid (50%) [34]. Traoré *et al.* reported a sensitivity of *Klebsiella pneumoniae* to colistin (94.1%); ceftazidime (81.3%); amikacin (78.6%) [37]. On the other hand, our study found that the strains are resistant to amoxicillin (100%); amoxicillin + clavulanic acid (66.66%) and ciprofloxacin (33.33%).

In the study by Maxwell *et al.* *Klebsiella pneumoniae* strains were resistant to amoxicillin + clavulanic acid and piperacillin (80%), cefalotin (53.33%), nalidixic acid (66.67%), sulfamethoxazole + trimethoprim and norfloxacin (60%).

In the elderly in France in 2014, Thibaut *et al.* recorded a sensitivity of *Klebsiella pneumoniae* strains to fosfomycin at 75%, cotrimoxazole at 35%, ciprofloxacin at 26% and nalidixic acid at 19% [36].

For *Pseudomonas aeruginosa*, the results of our study show that the strains of

Pseudomonas aeruginosa were sensitive to ceftazidime, amikacin and colistin at 100%.

For Moumile *et al.* the strains of *P. aeruginosa* were sensitive to ceftazidime and resistant to ciprofloxacin [23]. According to Maxwell *et al.*, *Pseudomonas aeruginosa* strains were sensitive to beta-lactams (imipenem, aztreonam, ceftazidime, cefepime and ticarcillin + clavulanic acid at 100% and to ticarcillin, piperacillin and piperacillin + tazobactam at 75%), aminoglycosides (gentamicin, tobramycin and amikacin at 75%, netilmicin at 33.33%), and ciprofloxacin (100%) [10]. According to Filali *et al.*, the most active β -lactams on *Pseudomonas Aeruginosa* are ceftazidime and imipenem. Amikacin was more active than gentamicin and almost 39% of the strains were resistant to ciprofloxacin [38].

5. Study Limitations

- The diagnosis of the urinary tract infection could not be made within 48 hours to allow us to distinguish between community and nosocomial infection.
- The distinction between simple and complicated urinary tract infection (parenchymal involvement) was not specified.
- Our sample size was relatively small and CBSU was not systematically performed.
- The inclusion criteria are based on the signs of call, thus underestimating the asymptomatic forms.

6. Conclusion

UTI is common in the elderly, its clinical presentation is polymorphic, and enterobacteria are the most incriminated group of bacteria.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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