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Epidemiological, Clinical, Paraclinical and Evolutionary Aspects of Urinary Tract Infection in Diabetics Hospitalized at the Department of Medicine of Abass Ndao Hospital from January 01, 2018, to December 31, 2018

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Abstract

Introduction: Urinary tract infection (UTI) is a major public health problem because of its morbidity and mortality. It occurs with increased frequency during diabetes. The objective of this work was to study the frequency and etiologies of urinary tract infections in diabetics hospitalized at the department of medicine of Abass Ndao Hospital. **Patients and Methods:** This work was a cross-sectional, descriptive, and analytical study conducted from January 01, 2018, to December 31, 2018. It focused on hospitalized diabetic patients with urinary tract infection. Epidemiological, clinical, and evolutionary data of UTI were evaluated. **Results:** One hundred and twenty-eight (128) diabetic patients had a cytobacteriological urine exam (CUE). 44 of who had a positive CUE (34.4%). The age group [60 - 69] years was the most represented (31.8%). Women predominated (61.4%) with a sex ratio (m/f) of 0.63. Abdominal pain was the most frequent reason for consultation, followed by polydipsia. Fever was recorded in 21 patients (47.7%). Type 2 diabetes was found in most patients (70.5%). Glycemia above 2g/l was found in 34 patients (89.5%). Anemia accounted for more than half of the patients with 29 cases (65.9%). Leukocytosis was noted in 28 patients (63.6%) and a positive CRP in 33 patients (75%). An increase in urea-creatinine was noted in 23 cases (52.3%).

The results of the CUE revealed *Escherichia coli* as predominant (43.2%, n = 19), followed by *Candida* with 22.7% (n = 10). Antibiotic therapy was given to all patients. The mostly used antibiotic in the treatment of UTI was Cefotaxime 27.3% (n = 12). Older age and female gender were associated with the presence of *E. coli*. Four (4) deaths were recorded (9%). They were all male over the age of 65. **Conclusion**: UTI in diabetes is an important cause of morbidity and mortality. The development and implementation of a prevention and management program are essential.

Keywords

Urinary Tract Infection, Diabetes, Risk Factors, Mortality, Senegal

1. Introduction

Diabetes is a public health problem due to its increased morbidity and mortality. It is a chronic metabolic disease, associated with a failure of the biological mechanisms of glycemia regulation, characterized by its evolution, most often insidious, leading to a delay in diagnosis responsible for the occurrence of complications. These infections are frequent [1]. These complications can be chronic degenerative but also acute metabolic or infectious complications, requiring long and expensive treatment. These acute complications deserve particular attention, including urinary tract infection [2].

Urinary tract infection (UTI) corresponds to the aggression of a tissue of the urinary tract by one or more microorganisms generating an inflammatory response and symptoms of varying nature and intensity depending on the terrain. UTIs are also a major public health problem, due to their morbidity and mortality, and their frequency, which ranks them, after respiratory infections, the second most common indication for antibiotic prescription [3]. UTIs occur with increased frequency in diabetes. The mechanisms are known and are due to the influence of hyperglycemia on neutrophils, increased bacterial adherence, decreased secretion of cytokines and bacterial quiescence. They are often asymptomatic but can be considered as a reason for diabetic imbalance. Moreover, they can take different forms and can be located in the lower urinary tract (cystitis, urethritis) or upper urinary tract (pyelonephritis). It is a complication that can be avoided by primary prevention. This motivated us to carry out this study with the general objective of determining the frequency and describing the epidemiological, clinical, paraclinical, therapeutic and evolutionary aspects of urinary tract infection in diabetics at the Abass Ndao Hospital in Dakar.

2. Materials and Methods

The study was conducted at the department of medicine of Abass Ndao Hospital in Dakar. This service is composed of 2 departments namely the Marc Sankalé Diabetes Center and the Internal Medicine Hospitalization Service with a capacity of 34 beds.

This was a retrospective descriptive cross-sectional study of diabetic subjects hospitalized at the internal medicine department of Abass Ndao Hospital in Dakar with a urinary tract infection. The recruitment of our patients was done over a year from 01 January 2018 to 31 December 2018.

All diabetic patients hospitalized in internal medicine during the recruitment period from January 1, 2018, to December 31, 2018, who presented a urinary tract infection and presented a complete file were included in our work. A standard questionnaire was established to serve as a basis for data collection for the patients included in the study. It covered marital status, clinical manifestations, biological and biochemical analyses, diabetes, and urinary tract infection. Data were collected from the records of patients meeting the inclusion criteria and hospitalized during the study period. The questionnaires were filled out from the hospitalization records reporting the clinical and paraclinical elements of the patients.

The data collected included:

− Socio-economic profile: age, gender, occupation, marital status, address.
− The study of diabetes mellitus: it was interested in the type of diabetes, its duration, existence or not of other cardiovascular risk factors (smoking, hypertension, obesity, dyslipidemia, age, alcoholism). Sedentary lifestyle was not evaluated because it was not recorded in the patients' files.
− Clinical manifestations.
− Paraclinical aspects: complete blood count (CBC), creatininemia, C reactive protein (CRP), HbA1c, lipidic balance, renal function, and micro albuminuria, CUE, scanner, magnetic resonance imaging (IRM), prostate ultrasound, retroviral serology (SRV), electrocardiogram (ECG).

The data were entered using Microsoft Office Excel and analyzed by epi info 2000 version 3.3.2. In the analysis, a descriptive and analytical study was made.

Ethical considerations: data were collected anonymously and treated confidentially.

3. Results

Frequency

One hundred and twenty-eight (128) diabetic patients had performed a CUE. Among them, 44 patients had a positive CUE, *i.e.* a frequency of 34.4%.

Epidemiological Aspects

The mean age was 55 years with extremes ranging from 15 to 87 years. The age range [60 - 69] was more representative with 14 patients or 31.8%. Table 1 shows the distribution of patients by age group (Table 1). The study population consisted of 27 women (61.4%) with a sex ratio (m/f) of 0.63. The patients were mainly from Dakar, 41 patients or 93.2%. Married people were more represented with 25 patients (56.8%). Housewives were in the majority with 14 cases (31.8%), followed by the unemployed with 10 patients (22.7%).

Regarding the antecedents, we noted 1 case of alcoholism (2.3%) and 2 cases of genital infection (4.5%). Among the risk factors, arterial hypertension was

Table 1. Distribution of patients by age group.

Age range	Workforce	Percentage (%)
<20	2	4.5
20 - 29	2	4.5
30 - 39	7	15.9
40 - 49	3	6.8
50 - 59	6	13.6
60 - 69	14	31.8
70 - 79	7	15.9
80+	3	6.8
Total	44	100

found in 12 patients, *i.e.* a frequency of 27.3%; overweight concerned 20 cases, *i.e.* 45.4%. We recorded 6 patients with urinary catheters, *i.e.* 13.6%.

Clinical and Paraclinical Aspects

Clinically, the average time between the onset of symptoms and consultation was more than 7 days in most patients. Abdominal pain was the most frequent reason for consultation with 13 cases or 29.5%, followed by polydipsia with 12 cases or 27.3%.

Fever was recorded in 21 patients or 47.7%.

The study of diabetes showed that type 2 was the most frequent with 31 cases or 70.5%. The level of blood sugar was higher than 2 g/l in 34 patients (77.3%). Most of our patients had diabetes evolving for more than 10 years with 19 cases or 43.18%. In this study, hyperglycemia dominated with 17 cases (38.6%).

Leukocytosis was noted in 28 patients or 63.6%, anemia in more than half of the patients with 29 cases or 65.9% and thrombocytosis in 18 patients or 40.9%. CRP was elevated in 33 patients (75%). Elevated creatinine and urea levels were noted in 23 patients (52.3%) with impaired renal function.

Urinary Tract Infection

The results of the CUE revealed *Escherichia coli* as predominant with 19 cases or 43.2%, followed by *Candida* with 10 cases or 22.7% (Table 2).

The ECG revealed that out of 37 patients checked, only 9 had no abnormality, *i.e.* 24.32%. We also had 1 case of infarction or 3%. Only 1 patient had an ultrasound of the prostate and showed an increase in the size of the prostate.

Antidiabetic

Metformin (Glucophage) was the mostly most used oral treatment with 17 cases (38.63%), followed by insulin with 14 cases (31.8%).

Antibiotics

Antibiotic therapy concerned all patients having a positive CUE. Dual therapy was used in 33 patients (75%). The mostly used antibiotic in the treatment of UTI was Cefotaxime with 12 patients or 27.3%. Table 3 shows the distribution of the population according to the antibiotic used for treatment.

Table 2. Distribution of patients according to the germs found.

Germs	Workforce	Percentage (%)
Escherichia coli	19	43.2
Candida (albicans or non-albicans)	10	22.7
Klebsiella pneumoniae	6	13.6
Escherichia coli + *Klebsiella oxytoca*	2	4.5
Klebsiella pneumoniae + *Candida* (albicans or non-albicans)	2	4.5
Staphylococcus aureus	2	4.5
Acinetobacter spp.	1	2.3
Pseudomonas spp. + *Flavobacterium spp.*	1	2.3
Staphylococcus saprophyticus	1	2.3
Total	**44**	**100**

Table 3. Distribution of population by antibiotic used for treatment.

ATB	Workforce	Percentage (%)
Amoxicillin-clavulanic acid	5	11.36
Cefotaxime	12	27.3
Ceftazidime	4	9.09
Gentamicin	3	6.81
Ciprofloxacin	6	13.6
Fosfomycin	2	4.54
Sulfonamide	1	2.27
Amikacin	3	6.81
Imipenem	6	13.6
Cefepime	4	9.09

The most used TBA families were beta-lactams (36.4%) in monotherapy with 11 cases or 25% and in dual therapy with 5 cases or 11.4%; followed by fluoro-quinolones with 11 cases or 25%.

The duration of hospitalization between 7 and 15 days included more patients with 23 cases or 63.9%.

Analytic Study

The predominant bacterium *Escherichia coli* was found more in patients over 60 years of age, *i.e.* 13 cases for 24.5%. Table 4 shows the distribution of patients according to bacteria and age.

The predominant germ *Escherichia coli* is more present in women 15 cases or 19.7% than in men 6 cases or 11.8%. Table 5 shows the distribution of patients according to the bacterium involved and gender.

Older age and female gender were associated with the presence of *E. Coli* UTI.

On the evolutionary level, four (4) deaths were recorded, *i.e.* 9.09; distributed

Table 4. Distribution of patients according to bacteria and age.

		Age 60		Total	P
		<60 years	>60 years old		
Acinetobacter spp.	Workforce	1	0	1	0.583
	%	1.4%	0%	8%	
Candida (albicans or non-albicans)	Workforce	6	6	12	0.542
	%	8.1%	11.3%	9.4%	
Escherichia coli	Workforce	8	13	21	0.040
	%	10.8%	24.5%	16.5%	
Klebsiella oxytoca	Workforce	1	1	2	0.662
	%	1.4%	1.9%	1.6%	
Klebsiella pneumoniae	Workforce	4	4	8	0.446
	%	5.4%	7.5%	6.3%	
Pseudomonas spp.	Workforce	0	1	1	0.417
	%	0%	1.9%	8%	
Flavobacterium spp.	Workforce	0	1	1	0.417
	%	0%	1.9%	8%	
Staphylococcus aureus	Workforce	0	2	2	0.172
	%	0%	3.8%	1.6%	
Staphylococcus saprophyticus	Workforce	1	0	1	0.583
	%	1.4%	0%	8%	

Table 5. Distribution of patients according to the bacteria involved and gender.

		SEX		Total	P
		F	M		
Acinetobacter spp.	Workforce	1	0	1	0.598
	%	1.3%	0%	8%	
Candida (albicans or non-albicans)	Workforce	6	6	12	0.332
	%	7.9%	11.8%	9.4%	
Escherichia coli	Workforce	15	6	21	0.236
	%	19.7%	11.8%	16.5%	
Klebsiella oxytoca	Workforce	2	0	2	0.356
	%	2.6%	0%	1.6%	
Klebsiella pneumoniae	Workforce	4	4	8	0.408
	%	5.3%	7.8%	6.3%	
Pseudomonas spp.	Workforce	0	1	1	0.402
	%	0%	2%	8%	
Flavobacterium spp.	Workforce	0	1	1	0.402
	%	0%	2%	8%	
Staphylococcus aureus	Workforce	1	1	2	0.644
	%	1.3%	2%	1.6%	
Staphylococcus saprophyticus	Workforce	0	1	1	0.402
	%	0%	2%	8%	

between *Escherichia coli* (n = 1), *Klebsiella pneumoniae* (n = 1), *Candida* (n = 1) *and Staphylococcus aureus* (n = 1). They were all male over the age of 65. Comorbidities such as gas gangrene, cerebrovascular accident and foot ulcer were noted.

4. Discussion

During the study period we found a hospital frequency of 34.4%. Lower frequencies were found in Ethiopia, Saudi Arabia, Tunisia with respectively 10.9; 13%, 19.5%, 24.74%; 25.3%; 25.9% [4]-[10]. Elsewhere in China, Ke He found a frequency of 11.2% of urinary tract infection in diabetics [11]. On the other hand, in India higher prevalence was found at a proportion of 42% and 45% respectively [12] [13].

The female gender was the most represented with 61.4% of cases, *i.e.* a ratio of 0.6. This finding is consistent with data found in the literature 41.1% versus 7.2% in men, 64.6% and 61.19% respectively in Morocco and Tunisia [10] [14] [15]. In developed countries such as France, prevalence of urinary tract infection in diabetic women are around 2/3 (76.2%) [16] [17]. In women, in addition to the anatomy of the pelvis, certain periods of life such as menopause or pregnancy, due to changes in hormonal status, favor the penetration of germs [17].

This frequency increases with age. It affects patients over 50 years of age in more than one third of cases. The age group mostly affected in our study was the sixties (31.8%), the average age was 55.11 ± 18.86 years. Our results were like those found in some studies [8] [9]. Age increases the frequency of infection, with 6% at 60 years of age and 10% at 70 years of age in women, and 4% in men over 60 years of age. Studies confirm this prevalence, which increases with age and in women [7] [8] [9] [10].

In our study, type 2 diabetes was in the majority with 31 cases or 70.46%. This finding is identical to what is described in the literature. This rate is lower than those observed in other studies, notably in Mali and France, which were 51.35% and 54% respectively [18] [19]. On the other hand, other authors have found higher proportions 80% [20].

We recorded 6 patients with urinary catheters, *i.e.* 13.64%. Urinary catheterization is the cause of 80% of nosocomial infections and the risk increases by 5% per day of catheterization. It is therefore important to verify the absence of urinary tract infection before each procedure, to prescribe antibiotic prophylaxis in certain situations and to monitor any post-procedure fever. Studies have shown the role of the urinary catheter remaining in place for too long with the possibility for microorganisms to colonize the catheter lumen or along the outside of the catheter and infect the bladder or kidneys, leading to a catheter-associated urinary tract infection [21] [22].

In a 2011 point-in-time prevalence survey, researchers identified urinary tract infections (UTIs) as the fourth most common healthcare-associated infection (HAI), accounting for more than 12% of infections in U.S. acute care facilities (n = 504).

Over 67% of these identified UTIs were associated with indwelling urinary catheters [23]. They estimated that of approximately 721,800 annual nosocomial infections, 93,300 urinary tract infections and 35,600 catheter-associated urinary tract infections occur in acute care hospitals in the United States [23]. The length of time a urinary catheter remains in the bladder directly affects the development of bacteriuria. The longer it is in place, the higher the risk of developing a urinary tract infection. And when contaminated urine flows through a catheter, microorganisms can attach to the catheter and be continually bathed by the warm nutrients in the urine. As a result, a protective gel can form and become a bacterial biofilm along the outer or inner surface of the catheter [24].

In all the literature cited above, urinary catheterization was a factor in the incidence of urinary tract infection in diabetics, so the low rate found in our study could be explained by the low use of urinary catheters in the study.

Diabetes has long been considered a predisposing factor for urinary tract infections [25]. Longer duration of diabetes may lead to an increased prevalence of chronic diabetic complications, more frequent hospitalizations, and urinary tract catheterization, all of which lead to an increased prevalence of UTIs [26]. Female gender and type 2 diabetes have been identified as significant risk factors for UTIs [27].

Abdominal pain was the most frequent reason for consultation with 13 cases or 29.5%, followed by polydipsia with 12 cases or 27.3%. We also recorded urinary burning 11.4% and fever in 21 patients or 47.73%. However, other symptoms such as dysuria, increased frequency of micturition, hematuria and back pain are also strong evidence for the diagnosis of urinary tract infection [16]. In addition, fever may also be predominant (18.6%), followed by burning of the urine (8.6%) and dysuria/pollakiuria (4.3%) [15]. Fever was recorded in 47.73% of patients in our study. UTI in diabetics can be either symptomatic or asymptomatic. Several studies have shown that the presence of asymptomatic bacteriuria (BA) is predictive of symptomatic infections in diabetics, as well as in patients without diabetes [28] [29] [30].

The infection was bacterial in 77.28% of cases and fungal in 22.7%. The results of the ECBU had revealed *Escherichia coli* as predominant with 47.7% of isolates, followed by *Candida albicans* or not with (22.7%) and *Klebsiella pneumoniae* in 13.6%. [28]. In contrast in 2014 had found that *E. coli* was the majority (73%), followed by enterococci (6.6%) and Klebsiella (5.6%) in France [29]. In Nepal (2013), UIS is dominated by *E. coli* (52%), followed by *K. pneumoniae* (14.29%), and *P. aeruginosa* (9.52%), Proteus (8.52%), *Enterococcus* (8.52%) and *Acinetobacter* (4.76%) [30].

The study conducted at the Endocrinology Department of the Bourguiba University Hospital of Monastira had found a predominance of *E. coli* (56.7%), followed by *Klebsiella* (29.9%) [31], on the other hand others isolated 70.2% *Escherichia coli*, 6% *Proteus mirabilis*, *Klebsiella pneumoniae* (2.7%), *Pseudomonas aeruginosa* (2.7%) in 1995 [32]. A retrospective study carried out in the bacteri-

ology laboratory of the Mohammed V Military Teaching Hospital in Rabat, on the bacteria isolated from 648 "positive" CUE 2011, showed that among the isolated germs 85.36% were enterobacteria with a predominance of *Escherichia coli* (51.06%), Gram-positive bacteria accounted for 7.31% of bacterial isolates On his part Legarzic and colleagues found *Escherichia coli* dominant (63.6%,) *Klebsiella pneumoniae* 6.3% [33], as well as Fisher and Deguine isolated *Escherichia coli* 63.6%, *Klebsiella pneumoniae* 6.3%, *Proteus mirabilis* 1.65% in France in 1997 [34]. But Abbou C *et al.* found 5% *Klebsiella pneumoniae*, 8% *Pseudomonas aeruginosa* and 5% *Proteus mirabilis* in France in 1994 [35]. Etienne M *et al.* stated that fungal infections of the urinary tract are rare in community medicine, but common in hospitals where 10% - 30% of urine cultures isolate *Candida species* [36]. Thomas L *et al.* explain in their article that mycosis, and candiduria particularly, is an increasingly common problem encountered by the practicing urologist. Moreover, its prevalence has increased and represented 22% of nosocomial urinary tract infections (UTI) from 1986 to 1989 and then 40% from 1992 to 1997. This fungal infection was associated with high acuity care, indwelling catheters, diabetes mellitus, antibiotic and steroid use, and urinary tract disease [37]. Thus, in most studies *E. coli* is predominant confirming our results.

The distribution of bacterial species during UTI in diabetics has been found in other works. In a recent study, the predominance of *Escherichia coli* (47.83%), *Klebsiella pneumoniae* (19.57%) and *Staphylococcus epidermidis* (4.34%) was confirmed. Several authors have found similar results. However, the presence of *candida* is also frequent in diabetics. Similar results have been observed in Tunisia [6]. This predominance of *E. coli* is found in cases of urinary tract infection even outside diabetes. Its presence is associated with age and sex in our study. This finding is comparable to other studies carried out elsewhere in Africa indicating 40% - 46% isolation of *E. coli* [38] [39] [40]. The high prevalence of *E. coli* in the female sex could be due to the proximity of the anus to the vagina, the inherent virulence but also its ability to adhere to the urinary tract and the association with other microorganisms moving from areas of the perineum contaminated with fecal microbes to the warm and moist environment of the female genitalia [41] [42].

The antibiotic mostly used in the treatment of UTI in our study was cefotaxime with 12 patients or 27.3%. We also noted the use of dual therapy in some patients 11.4%. Amoxicillin + clavulanic acid was prescribed in 11.36% (n = 5); while ciprofloxacin and imipenem each 6 cases or 13.6%. Other antibiotics were used but weakly such as ceftazidime 9.09%, gentamicin 6.8%, Fosfomycin 4.5%, sulfonamide 2.3%, amikacin 6.8% and cefepime 9.1%. Antibiotic treatment for UTI is becoming increasingly difficult due to the increase in antimicrobial resistance [43]. In addition, antibiotic treatment exerts collateral effects such as intestinal dysbiosis that can create niches for colonization by multidrug-resistant pathogens, which may eventually dominate the intestinal microflora [44] [45] [46] [47]. Patient treatment depends on the causative bacteria, microbial ecology, and sensitivity of the patient's strain. Most patients (63.9%) have a hospital stay of

between 7 and 15 days. This duration is like the results found in other similar African studies.

5. Conclusion

Urinary tract infections are very often found in diabetics. *E coli* is the most common germ found. On the other hand, its frequency is much more observed in diabetics not controlled by treatment. So good control of diabetes remains one of the best strategies for preventing urinary tract infections.

Limitations of the Study

We encountered difficulties during this study, particularly regarding the completeness of the clinical data.

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Authors' Contributions

NGOM Ndeye Fatou, Sow Djiby: design, data collection, data curation, statistical analysis, writing original draft and manuscript review. Other authors: design, writing, manuscript review and editing. All the authors have read and approved the final version of the manuscript.

Conflicts of Interest

The authors certify that they have no affiliation with or involvement in any organisation or entity with a non-financial interest or stake in the subject matter of this manuscript. The authors did not receive any specific funding for this work.

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