EPIDEMIOLOGICAL AND BACTERIOLOGICAL PROFILE OF URINARY TRACT INFECTIONS DIAGNOSED AT THE BACTERIOLOGY LABORATORY OF THE CENTRE HOSPITALIER UNIVERSITAIRE DE FANN, DAKAR FROM JANUARY 1ER TO DECEMBER 31 2020

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ABSTRACT: *Introduction Urinary tract infections are extremely frequent and caused by bacteria whose treatment is based on the administration of antibiotics. The emergence and spread of acquired resistance mechanisms are limiting the indications for a number of antibiotics. It is in this context that this work is set, the main objective of which is to study the epidemiological and bacteriological profile of urinary tract infections at the CHNU de Fann, Dakar.* **Methodology:** *This is a retrospective study covering a one-year period from January 1er to December 31 2020. All patients received at the laboratory for an ECBU request were included. Data collection was based on information sheets and bench registers. The following information was collected : age, sex, germ isolated, antibiotic susceptibility profile. These data were processed using R. Studio software version 3.6.3, 2019.* **Results :** *We received 3697 requests for bacteriological examination of urine. The mean age of patients in our series was 48.7 years, with extremes of 15 days and 113 years. The 60 to 80 age group was the most affected. Women were more affected, with a rate of 51.03%, compared with 48.97% for men. A total of 3,697 urine samples were received during the study period, of which 776 were positive after analysis, representing a rate of 21%. 845 bacteria, with enterobacteria predominating (73.14%), followed by Gram-negative non-fermentative bacilli (13.37%) and Gram-positive cocci (13.27%). Escherichia coli was the most prevalent species, with a frequency of 36.09%, followed by Klebsiella pneumoniae (17.99%), Pseudomonas aeruginosa (8.16%), Staphylococcus aureus (6.63%), Enterobacter spp (6.50%), Citrobacter spp (4.02%), Acinetobacter spp (3.73%), Streptococcus spp (3.67%).Enterobacter spp (52.72%), Escherichia coli (47.53%) and Klebsiella pneumoniae (49.34%) showed a high prevalence of ESBL. Staphylococci showed a high rate of resistance to methicillin (55.71%).*

KEYWORDS: CHNU Fann, urinary tract infections, antibiotic resistance.

INTRODUCTION

Today, urinary tract infections (UTIs) represent a major public health problem worldwide, accounting for a significant morbidity and mortality rate **[1]** . The bacteria most often implicated are enterobacteria, the natural hosts of the intestine and the environment (*Escherichia coli*, *Proteus*, *Klebsiella*, *Pseudomonas...*). *Escherichia coli* (*E. coli*) accounts for 70-80% of bacteria isolated in urinary tract infections **[2],** and requires appropriate diagnosis and optimal antibiotic treatment, based on local epidemiological data on bacterial susceptibility and analysis of antibiogram data to tailor antibiotic therapy **[3].** There is a risk of clinical failure due to the lack of real prospects for new families of antibiotics, but also due to the evolution of multi-resistance. In the long term, these risks can lead to an increase in urinary tract infections, which in turn creates a health problem.

PATIENTS AND METHODS

We exploited the results 3697 requests for urine cytobacteriological examination (ECBU) performed at the laboratory of bacteriology and virology of the CHNU de Fann in Dakar from January 01 to December 31, 2020.Data were collected from bench registers using Microsoft Excel 2013. These data were subsequently transferred and processed on R.Studio software version 3.6.3, 2019. Categorical variables are expressed as percentages. Comparisons were made using the (khit2) test, and P-value values below 5% were considered significant.

The antibiogram technique used was diffusion on agar or Kirby-Bauer medium. The inoculum was produced from a pure culture, then adjusted to 0.5 Mac Farland. Mueller-Hinton (MH) medium was used for antibiotic susceptibility testing. Inoculation was performed by swabbing.

RESULTS

The mean age of patients in our study series was 48.7 years, with extremes of 15 days and 113 years. Of the 3,697 patients who underwent ECBU, 1,961 (53%) were women, compared with 1,736 (47%) men, giving an F/M sex ratio of 1.12 (Figure 1)
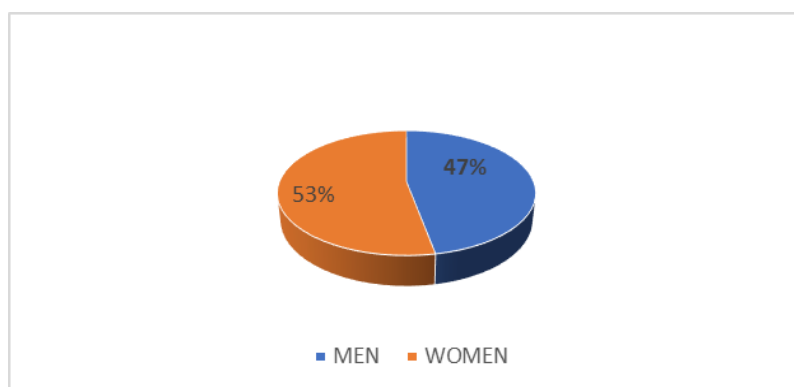

Figure 1: Distribution of patients by gender

Of the 3,697 patient urine samples analyzed, 776 were positive, representing a positivity rate of 21%. Among these patients, the most affected age group was between 61 and 80, with 321 cases (41.36%), followed by the 41 to 60 age group, with 201 patients or 26%. Of all infected patients, women were more affected by urinary tract infections than men, with a rate of 51.03% (396 patients).
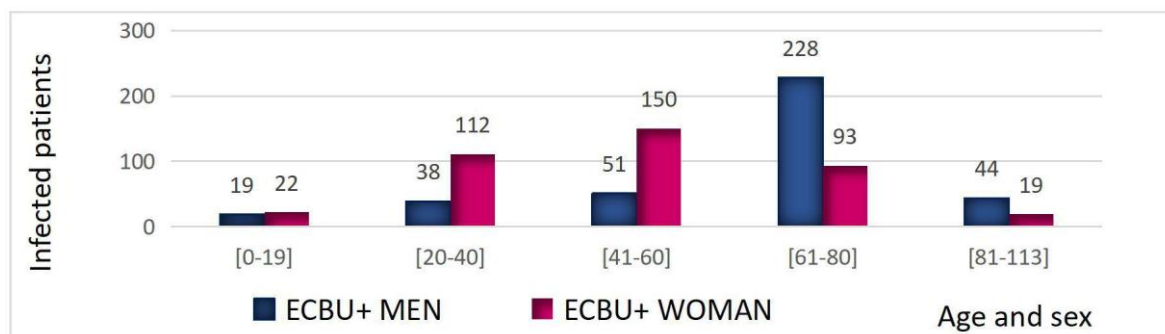
Figure 2: Distribution of urinary tract infections by age and gender

In the course of our study, we isolated 845 bacteria, with enterobacteria predominating (73.14%), followed by non-fermentative Gram-negative bacilli (13.37%) and Gram-positive cocci (13.27%). *Escherichia coli was the* most common species, with a frequency of 36.09%, followed by *Klebsiella pneumoniae* (17.99%), *Pseudomonas aeruginosa* (8.16%), *Staphylococcus aureus* (6.63%), *Enterobacter spp* (6.50%), *Citrobacter spp* (4.02%), *Acinetobacter8/8 spp* (3.73%), *Streptococcus spp* (3.67%) (Figure 3).
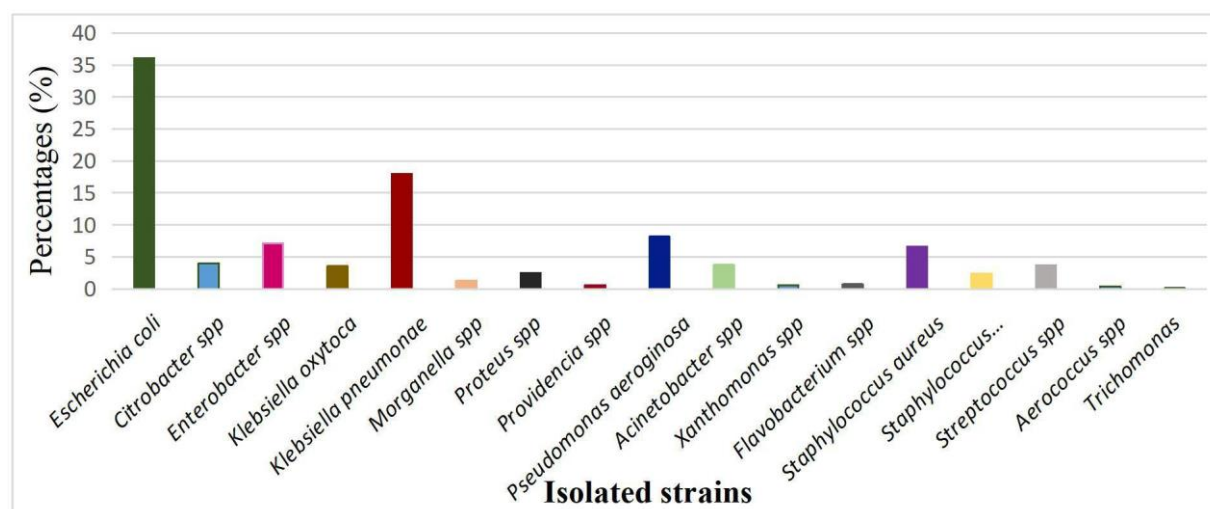
Figure 3: Mapping of isolated germs

A study of the antibiotic susceptibility of isolated Enterobacteriaceae revealed a high prevalence of ESBL, which was highest among *Enterobacter spp.* strains, with a frequency of 52.72%. *Escherichia coli and Klebsiella pneumoniae also showed a high rate of ESBL production, with* 47.53% and 49.34% of strains isolated *respectively* (Figure 4).
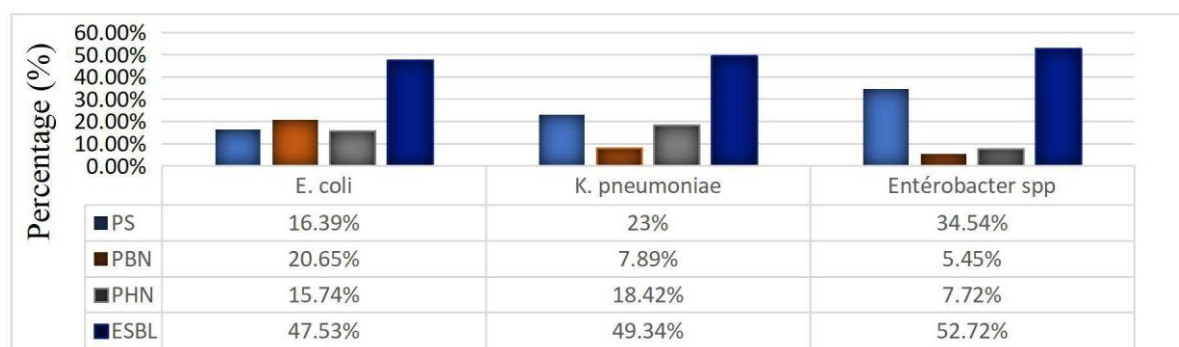
Figure 4 : Enterobacteriaceae resistance phenotypes to betalactam antibiotics

ESBL: extended-spectrum beta-lactamase,

PHN : high-level penicillinase

 PBN : low-level penicillinase

 PS : wild-type phenotypes

In the study of non-fermentative BGN resistance, we find that *Pseudomonas aeroginosa* is highly resistant to the antibiotics tested : ticarcillin 60.87%, ciprofloxacin 42.03%, cefepime 43.47%... Like *Acinetobacter spp,* it also displays very high antibiotic resistance, especially to ticarcillin 53% and ceftazidime 50% (Table I).

Table I: Resistance of non-fermentative BGN to antibiotics

Antibiotics		Number of resistant n (%)	
		Pseudomonas aeroginosa (N=69)	Acinetobacter spp (N=34)
Betalactam antibiotics	Ticarcillin	42 (60,87%)	18 (53%)
	Ceftriaxone	44 (63,77%)	11 (32,35%)
	Ceftazidime	15 (21,74%)	17 (50%)
	Cefepime	30 (43,47%)	15 (44,12%)
	Imipenem	25 (36,23%)	9 (26,5%)
Other	Ciprofloxacin	29 (42,03%)	14 (41,12%)
	Levofloxacin	28 (40,58%)	11 (32,35%)
	Pefloxacin	28 (40,58%)	12 (35,3%)

A study of *Staphylococcus* antibiotic resistance phenotypes revealed a high rate of resistance to meticillin (Meth R) : 55.71% for *Staphylococcus aureus* and 50% for *Staphylococcus saprophyticus*. %). There was also a regression in wild-type phenotypes (WPS), especially in *S. aureus* (19.28%) (Figure 5).
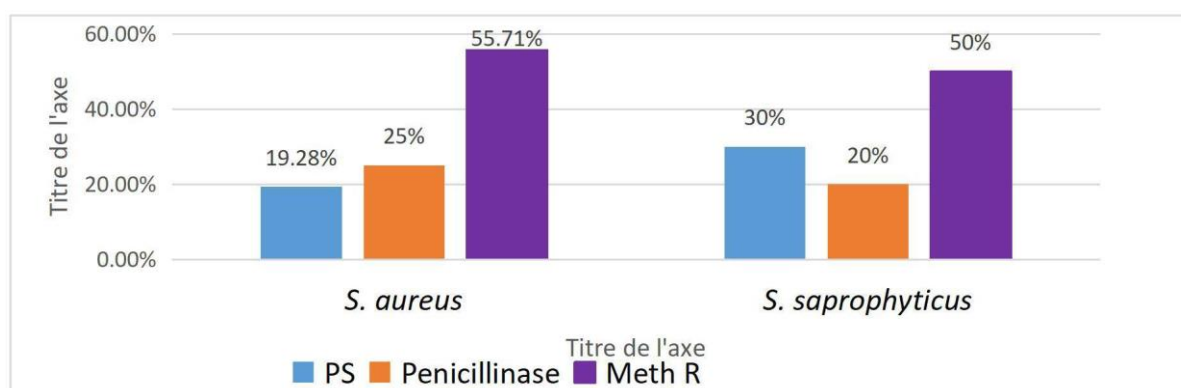
Figure 5 : Staphylococcal antibiotic resistance phenotypes

Of all the streptococci isolated (N=31 strains, i.e. 3.67%), resistance to beta-lactams was high: penicillin 61%, oxacillin 58%, cefoxitin 35.5%, and to quinolones, with greater resistance to ciprofloxacin (71%) and norfloxacin (52%). Resistance is also high to lincomycin (58.1%).

DISCUSSION

Microbiological tests are one of the most frequently requested paraclinical examinations in everyday pathology, including the urine cytobacteriological test (UCT). The latter accounts for a third of all bacteriological tests ordered by clinicians.

The aim of the present study was to investigate urinary tract infections in patients received at the bacteriology-virology laboratory of Fann Hospital from January 1er to December 31 2020.

In our study, the prevalence of urinary tract infections (UTIs) was 21%. Our results are similar to those of **Khalid** in 2011 **[4]** who had a rate equal to 23.78% in his study carried out in Morocco. In Senegal, **Yacine [1]** reported a prevalence of 11.68% in 2014 at the bio24 laboratory in Dakar. However, studies carried out by Sissoko in 2006 **[5]** in Mali and by **Mouhamadi** in 2020 **[6]** in an incidence study carried out in a urology department in Algeria revealed prevalences of 27.6% and 28.97% respectively. This difference in prevalence could be explained by geographical origin, by the methods used to test for germs, or by sample size.

The mean age in our study population was 48.7 years, with extremes of 15 days and 113 years. Females predominated, with 53% women and 47% men, corresponding to a sex ratio of 1.12:1. In this study, the prevalence of UTIs increased with age (19.33% between 20 and 40 years, 25.9% between 41 and 60 and 41.36% between 61 and 80), and the age of predilection for UTIs

in women was 20 to 60 years, with a proportion of 72.2% versus 27.8% for men. These results could be explained in women by the contiguity of the terminal digestive tract and the urogenital tract in the perineal air and the brevity of the female urethra, but also by an imbalance in the bacterial saprophyte flora of the vagina and urethra due to over-hygiene, as well as by the prescription of oestroprogestogenic treatment, a sexually transmitted infection or, on the contrary, anorectal colonization due to poor hygiene [7]. During intercourse, the urethra may be subjected to discrete traumas that favour the entry of germs [8]. On the other hand, in men, urinary tract infections are more common in older subjects (over 60), accounting for 70.83% of patients. This could be explained by the frequency of obstructive uropathies (benign prostatic hypertrophy in particular) and the loss of bactericidal properties of prostatic secretions [9].

Female predominance is observed in patients aged between 20 and 60, and male predominance is found in subjects aged over 60, which is in line with the data reported by **Abdourahman [10]** in his study carried out at Hôpital Générale de Grand Yoff in 2019, where female predominates from 21 to 60 years of age, accounting for 54.4% in the 21 to 40 age bracket and 50.2% in the 41 to 60 age bracket. For patients aged over 61, the male gender was more prevalent, with a rate of 82%.

In the present study, 845 germs were isolated, and we found that gram-negative bacilli were the most frequently encountered bacteria, with enterobacteria predominating, in particular *Escherichia coli* with 36.09% of cases, followed by *Klebsiella pneumoniae* and *Pseudomonas aeruginosa* (non-fermentative) with 17.99% and 7.69% respectively, and *Entérobacter spp* (7.10%). Gram-positive cocci accounted for 13.14% of isolates, of which 9.7% were *Staphylococci* and *Streptococci* with a prevalence of 3.6%. In Dakar, a bacteriological study showed that *Escherichia coli* was the most frequently isolated germ (39.92%), followed by *Klebsiella pneumoniae* (17.96%) and *Pseudomonas aeruginosa* (7.5%) [11]. In a study carried out at Ledantec Hospital (Dakar), *Escherichia coli* represented 36.21%, *Pseudomonas aeruginosa* 27.59% and *Klebsiella pneumoniae* 20.69%[12]. The bacterial epidemiology of UTIs is characterized by the predominance of enterobacteria, particularly *Escherichia coli,* since this germ forms the intestinal flora and can migrate easily from the intestine to the urinary tract [7]. In addition, *Escherichia coli* is a fecal coliform, so improper cleaning of the intimate area can easily lead to infection [13]. However, *Klebsiella pneumoniae plays* a very important role, accounting for 17.99% of isolates, followed by *Pseudomonas aeruginosa* (7.69%) and *Proteus spp* (2.5%). According to **Larabi *et al* in 2003 [14]**, these bacteria secrete a urease that alkalinizes urine (whose naturally acidic pH prevents the proliferation of germs) and causes the precipitation of struvite stones.

The study of enterobacterial susceptibility to antibiotics showed different phenotypes. *Enterobacter spp* was the most ESBL-producing strain (52.27%), followed by *K. pneumoniae* (49.53%) and *E. coli* (47.53%). These results differ from those obtained by other authors. In 2012, **Saye [15]** found in a study carried out in Bamako that *K. pneumoniae* and *E. coli* species predominated among ESBL-producing Enterobacteriaceae strains, with 43.4% and 32.3% respectively from 2006 to 2008. The emergence of ESBLs in Enterobacteriaceae strains is linked to the significant increase in the use of third-generation cephalosporins, and to the plasmid determinism of ESBLs, giving them species-to-species transmission [16].

In this study, *E. coli* was the dominant species and was found to become increasingly resistant with a wild-type phenotype (PS) 16.39%, low-level penicillinases (PBN) 20.65% and high-

level penicillinases (PHN) 15.74%. Furthermore, **Cissé** in 2020 **[17]** found similar results in his study carried out in Mali, with 18.6% PS, 6.6% PBH and 9.8% PBN. This may be explained by the high prescription of C3Gs in hospitals, and also by the lack of control over consumption (self-medication, break in treatment, etc.). **Belmonte** *et al* in 2010 **[18]** made the same observation.

In the study of resistance of non-fermenters such as *Pseudomonas aeroginosa* to beta-lactams and other antibiotics tested, high resistance rates were obtained: ticarcillin 60.87%, ceftriaxone 63.77%, ceftazidime 21.74%, cefepime 43.47%, ciprofloxacin 42.03%, levofloxacin 40.58%. Imipenem was not spared from resistance, reaching a rate of around

36.23%%. These results show that our strains are more resistant than those reported in other studies carried out by **Chouh** *et al.* in 2019 **[19]** in Algeria, with 46.2% for ticarcillin and 20.5% for ceftazidime. The trend shows a very rapid increase in *P. aeruginosa* resistance. This could pose a real problem in management, given the innate existence of natural resistance to many antibiotic molecules.

With regard to cocci, the Meti R phenotype was dominant, especially in *S. aureus,* with a proportion of 55.71%. This rate is very high compared with those reported in 2006 by **Mastouri** *et al.* in Tunisia (15%) and by **Heykel** in Dakar (25%) in 2015 **[20,21]**. These differences in values just go to show how quickly staphylococci acquire resistance to other antibiotics.

CONCLUSION

Our results show the extent of resistance and its impact on the limited choice of antibiotics for the appropriate management of bacterial infections in general and urinary tract infections in particular. Our findings concerning the evolution of germ resistance to antibiotics show that these bacteria have acquired increased resistance to beta-lactam antibiotics. Our results remain preliminary, and need to be extended to a larger, more representative population, with the isolation of a greater number of strains.

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