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Study of antibiotic susceptibility of uropathogenic germs and epidemiology in patients at the Ignace Deen National Hospital in Conakry (Republic of Guinea)

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ABSTRACT

Out of 228 urines analysed, the prevalence was 85%. Married people are the most exposed, with 78%. Households (30%), administrative staff (19%) and patients from the commune of Kaloum (35%) were the most represented. 58% were male, with a sex ratio (male/female) of 0.73. The 51 and over age group was the most affected with 32%, followed by the 21-30 age group with 19% and the 31-40 age group with 16%. The age groups least represented were 11-20 and 0-10 with 5% and 6% respectively. Married people are the most affected, with 82%, compared with 18% of single people. The married/single ratio is 4.5. Housewives are the most represented with 15%, followed by sales staff with 18% and pupils/students with 13%. Patients from the Urology department accounted for 45%, followed by Gynaecology with 21%, Rheumatology with 12%, and patients from elsewhere accounted for 10%. Patients from the commune of Kaloum were the most represented with 36%, followed by patients from outside Conakry with 20% and Matam with 19%. 61% of the urine was clear, 33% turbid and 6% haematic. 15% of urine was germ-free, 63% contained gram-negative bacilli and 37% gram-positive cocci. Leukocyturia was significant in 86% of cases. Epithelial cells were present in 6%, haematuria in 3%, yeast in 3% and oxalate crystals in 2%. The germ *Escherichia coli* was the most incriminated in 40% followed by *Staphyloccus aureus* with 32%, *Klebsiella pneumoniae* with 8%, *Pseudomonas aeruginosae* with 5%, *Acinetobacter baumannii* with 3% and *Staphylococcus haemolyticus* with 2% and the other germs were 1%. Antibiotics such as amikacin were effective in 63%, Nitrofurantoine in 79% and Imipenem in 76%.

Contribution/Originality: The aim of this present work was to determine the sensitivity profile of bacteria isolated from urogenital infections and to study the epidemiological aspect of these infections in the populations studied.

1. INTRODUCTION

Urinary tract infections are caused by microorganisms colonising the various organs of the urinary tract. These infections can affect all parts of the urinary system (kidneys, ureter and bladder) [1]. They are much more common

in women than in men, and even young children are not immune to these infections. The most common symptoms are a burning sensation when urinating, lower abdominal pain and leucorrhoea [1]. According to the World Health Organisation (WHO), more than 200 million people are affected by urinary tract infections in tropical environments, particularly in Third World countries where hygiene conditions are precarious. These infections account for 40% of all tropical diseases other than malaria [2].

In the United States, it is estimated that 20% to 40% of women have already had at least one urinary tract infection. Many women will contract them several times during their lives. Young men, on the other hand, are little affected by this condition [3]. In Canada, more than 65,000 cases were reported by the World Health Organization [4] and Savoye-Rossignol [5]. In France, 20-25% of hospital-acquired infections are nosocomial urinary tract infections [5]. In Africa, the prevalence rate among women of childbearing age varies from one country to another. In Guinea Bissau, it is 20% [6]. In Mauritania, 10% according to a 2008 study [7]. In the Republic of Guinea in 1996, urological emergencies accounted for 7.70% of medical and surgical emergencies at the Ignace-Deen National Hospital in Conakry and 60% of admissions to the department. Although the majority of patients came from Lower Guinea (67.9%), Upper Guinea and Forest Guinea were poorly represented, with 7.8% and 2.2% respectively [8].

The aim of this present work was to determine the sensitivity profile of bacteria isolated from urogenital infections and to study the epidemiological aspect of these infections in the populations studied.

2. MATERIALS AND WORKING METHODS

2.1. Working Methods

This is a prospective and descriptive cross-sectional study lasting three months, from 02 September to 03 December 2020. Our study population consisted of all patients attending the Ignace Deen University Hospital during our survey period. Our sampling was simple random and the sample size (n= 175) was calculated using the average prevalence of hospital-acquired urinary tract infections in Conakry (18%) by the SCHWARTZ formula. Our study included all patients who came to the laboratory with a report or examination booklet requesting a urine cytobacteriological examination (UBE). Colonies were counted on CLED medium (Cystine Lactose Electrolyt Deficient = medium enriched in cystine and lactose and low in ions). The urine germ count (UGC) is calculated according to the following formula: UGC /ml = N * 100. Bacterial count isolated from urine on agar. Orientation test: Oxidase. The antibiogram was performed using the Vitec 2 Compact identification and antibiogram device.

2.2. Study Variables

2.2.1 Biological Variables

- Urine cytobacteriological examination.
- Antibiogram.

2.2.2. Epidemiological Variables

- Age.
- Sex.
- Marital status.
- Profession.
- Requesting department.
- Residence.

2.3. Antibiotic Families Used

Aminosides, Quinolones, Nitrofurans, Trimethoprimes/sulfamethoxazoles, Lincosamides, Macrolides, Linezoides, Glycopeptides and β-lactam antibiotics.

2.4. Ethical Considerations

Before any questionnaire was administered, the consent of each patient was sought, the rationale for the work was explained beforehand, and they were reassured that the data would be reported anonymously.

2.5. Data Collection and Analysis

The data were collected using pre-established survey forms and laboratory registers, then tabulated, entered, processed and analysed using Word and Excel software under Windows 2010 and SPSS.

3. RESULTS

The application of the research methodology has led to the following results in the form of tables and graphs, which have been interpreted, commented on and discussed in the light of the available literature.

Table 1. Distribution of urine by macroscopic appearance.

N°	Aspect	Number	Percentage
1	Clear	26	15
2	Cloudy	132	75
3	Slightly cloudy	12	7
4	Thematic	5	3
Total		175	

This Table 1 shows that of the 175 patients seen in the laboratory, 132 patients (75%) had cloudy urine due to the presence of cellular and acellular elements and microorganisms in suspension, 26 patients (15%) had clear urine, 12 patients (7%) had slightly cloudy urine and 5 patients (3%) had haematic urine. Cloudy urine is typical of bacterial infections.

Table 2. Distribution of urine by cytology.

N°	Cytology	Number	Percentage
1	Leukocytes	151	86
2	Haematuria	5	3
3	Epithelial cells	10	6
4	Oxalate crystals	3	2
5	Yeasts	6	3
6	Parasites	-	-
Total		175	100

In this Table 2, we see that out of 175 patients complaining of urinary tract infections, 151 patients had urine containing leukocytes, i.e. 86%. However, 2% of patients had urine containing oxalate crystals, 3% haematuria, 7% epithelial cells and 4% yeast. Leukocyturia is the tell-tale sign of urinary tract infections, particularly by bacteria.

Table 3. Overall prevalence of urinary tract infections in patients.

N°	Test results	Number	Percentage
1	Positive	149	85
2	Negative	26	15
Total		175	100

In this Table 3, we see that out of 175 patients received at the laboratory, the majority suffer from a urinary infection, with 149 positive cases, i.e. a prevalence of 85%, compared with 26 negative cases, i.e. 15%.

This very high prevalence can be explained by the multiplicity of sexual partners and polygamy.

Table 4. Distribution of germs isolated according to Gram stain.

N°	Microbial agents	Number	Percentage
1	Gram- Bacilli	94	63
2	Gram-Positive bacilli	-	-
3	Gram+ Cocci	55	37
Total		149	100

Analysis of this Table 4 shows that, out of 149 patients with urinary tract infections, Gram-negative Bacilli are the most frequently incriminated with 94 cases, or 63%, followed by Gram-positive Cocci with 55 cases, or 37%.

Table 5. Breakdown of patients with urinary tract infections by bacterial species.

N°	Germs	Number	Percentage
1	*Staphylococcus aureus*	47	32
2	*Staphylococcus hemolyticus*	3	2
3	*Staphylococcus saprophyticus*	1	1
4	*Staphylococcus hominis ssp*	1	1
5	*Staphylococcus worneri*	2	1
6	*Staphylococcus xylosus*	1	1
7	*Klebsiella pneumoniae*	12	8
8	*Pseudomonas aeruginosa*	8	5
9	*Escherichia coli*	61	40
10	*Proteus mirabilis*	2	1
11	*Enterbacter aerogenes*	1	1
12	*Acinobacter baumannii*	4	3
13	*Citroacter freundii*	1	1
14	*Enterococcus fecalis*	1	1
15	*Serratia fonticola*	1	1
16	*Providencia stuartii*	1	1
17	*Enterobacter cloacae*	2	1
Total		149	100

Analysis of this Table 5 shows that urinary tract infections are caused by a large number of germs (17 species). However, of the 149 patients with urinary tract infections, Escherichia coli led the way with 61 cases, or 40%, followed by Staphylococcus aureus with 47 cases, or 32%. Other species were only moderately represented.

Table 6. Sensitivity of germs isolated to aminoglycosides.

Sensitivities	Amikacin		Gentamycin		Tobramicin	
	Number	%	Number	%	Number	%
Sensitive (S)	93	63	5	3	58	39
Intermediate (I)	2	1	0	0	3	2
Resistant (R)	20	13	59	40	37	25
Not determined (ND)	34	22	85	57	51	34
Total	149	100	149	100	149	100

From this Table 6, we can see that amikacin was the most effective on germs (63%), followed by Trobamycin (39%) and Gentamycin (3%). This sensitivity of germs to aminoglycosides may be due to the fact that aminoglycosides have a broad spectrum of activity and a significant bactericidal effect, which are major advantages.

Table 7 shows that the sensitivity of germs to Quinolones is very low. Nalidixic Ac 12%, Ciprofloxacin 31% and Ofloxacin 13%. This high resistance of germs to Quinolones could be due to chromosomal and plasmid mechanisms.

Table 7. Sensitivity of germs isolated to Quinolones.

Sensitivities	Nalidixic acid		Ciprofloxacin		Ofloxacin	
	Number	%	Number	%	Number	%
Sensitive (S)	19	13	46	31	19	13
Intermediate (I)	2	1	3	2	11	7
Resistant (R)	88	59	73	49	89	60
Not determined	40	27	27	18	30	20
Total	149	100	149	100	149	100

Table 8. Sensitivity of germs isolated to Nitrofurans.

Sensitivities	Nitrofurans	
	Number	Percentage
Sensitive (S)	117	79
Intermediate (I)	5	3
Resistant (R)	10	7
Not determined (ND)	17	11
Total	149	100

Analysis of this Table 8 shows the Nitrofuran class is represented by a single antibiotic, Nitrofurantoin. Of the 149 patients, Nitrofurantoin was sensitive to the germs, i.e. 79%, and was resistant to 10 patients, i.e. 7%. We can conclude that Nitrofuran reacts very well with the germs isolated.

Table 9. Sensitivity of isolated germs to trimethoprim/sulfamethoxazoles.

Sensitivities	Trimethoprim/Sulfamethoxazoles	
	Number	Percentage
Sensitive (S)	15	10
Intermediate (I)	-	-
Resistant (R)	105	71
Not determined (ND)	29	19
Total	149	100

This Table 9 shows the Timethoprim/sulfamethoxazole classe was not effective against the germs isolated from the 149 patients. Germs were resistant to Timethoprim/sulfamethoxazole in 105 samples, or 71%.

Table 10. Sensitivity of isolated germs to Lincosamides.

Sensitivities	Clindamycin	
	Number	Percentage
Sensitive (S)	6	4
Intermediate (I)	-	-
Resistant (R)	9	6
Not determined (ND)	134	90
Total	149	100

The Table 10 shows that Clindamycin was not effective against the germs in 134 cases, or 90%.

Table 11. Sensitivity of isolated germs to macrolides.

Sensitivities	Erythromycine		Quinupristine	
	Number	Percentage	Number	Percentage
Sensitive (S)	6	4	10	7
Intermediate (I)	-	-	1	1
Resistant (R)	13	9	6	4
Not determined (ND)	130	87	132	88
Total	149	100	149	100

In this Table 11, we can see that Macrolides were not effective on germs isolated from 149 samples from patients with urinary tract infections, with sensitivity to these antibiotics undetermined (indetermined) in 130 cases for Erythromycin, i.e. 87%, and 132 cases for Quinupristin, i.e. 88%.

Table 12. Sensitivity of isolated germs to Linezoids.

Sensitivities	Linezoids	
	Number	Percentage
Sensitive (S)	19	13
Intermediate (I)	-	-
Resistant (R)	15	10
Not determined (ND)	115	77
Total	149	100

In this Table 12, we see that antibiotics belonging to the Linezoides class, very few germs are sensitive to them: germs isolated from only 19 patients are sensitive, i.e. 13%, resistant germs from 15 patients, i.e. 10%, and undetermined sensitivity represents almost all the germs isolated, i.e. 77%.

Table 13. Sensitivity of isolated germs to glycopeptides.

Sensitivities	Vancomycins	
	Number	Percentage
Sensitive (S)	15	10
Intermediate (I)	-	-
Resistant (R)	20	13
Not determined (ND)	114	77
Total	149	100

In this Table 13, the Glycopeptide family is represented by a single antibiotic, Vancomycin. Of the germs isolated from 149 patients, Vancomycin was not effective in the vast majority (77%). However, sensitivity was observed in 15 cases (10%).

These results show a high sensitivity to Imipenem (76%), Cefoxitin (21%) and Ertapenem (64%). On the other hand, resistance to Ampicillin (72%), Ticarcillin (70%) and Ceftazidime (61%). This resistance could be due to the bio-resistance of E.coli and other germs involved in urinary tract infections.

Table 14. Sensitivity of isolated germs to β-lactam antibiotics.

Sensitivities	AMP		TIC		TZP		CXT		CTX		CAZ		ERT		IMI	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Sensitive	3	2	3	2	39	26	32	21	97	67	22	15	95	64	112	76
Intermediate	0	0	0	0	7	5	7	5	2	1	0	0	0	0	2	1
Resistant (R)	107	72	105	70	68	46	46	31	17	12	91	61	17	11	2	1
ND	39	26	41	28	35	23	64	43	33	22	36	24	37	25	33	22
Total	149	100	149	100	149	100	149	100	149	100	149	100	149	100	149	100

Note: AMP: Ampicillin; TIC: Ticarcillin; TZP: Piperacillin/Tazobactam ; CXT: Cefoxitin; CTX: Cefotaxime; CAZ: Ceftazidime; ERT: Ertapenem and IMI: Imipenem.

Table 14 shows a high sensitivity to Imipenem (76%), Cefoxitin (21%) and Ertapenem (64%). On the other hand, resistance to Ampicillin (72%), Ticarcillin (70%) and Ceftazidime (61%). This resistance could be due to the bio-resistance of E.coli and other germs involved in urinary tract infections.

The Figure 1 shows that urinary tract infections affect all age groups. Of the 149 patients with urinary tract infections, the majority were in the 61+ age group, with 47 cases, or 32%, followed by the 21-30 age group, with 29 cases, or 19%. Children and adolescents are the least represented in this series, with 9 and 8 cases respectively, i.e. 6% and 5%.

The high prevalence among the elderly and adults is certainly due to the high frequency of sexual activity or reduced immunity.

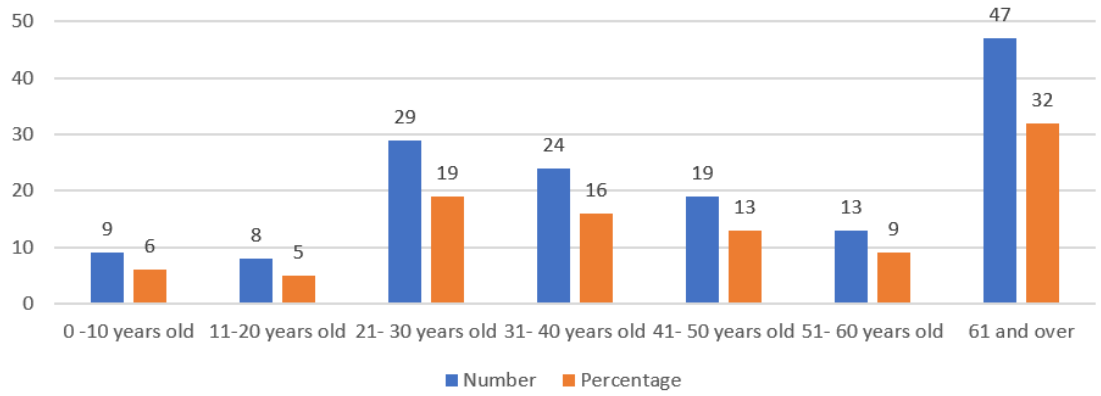

Figure 1. Breakdown of patients with urinary tract infections by age group.

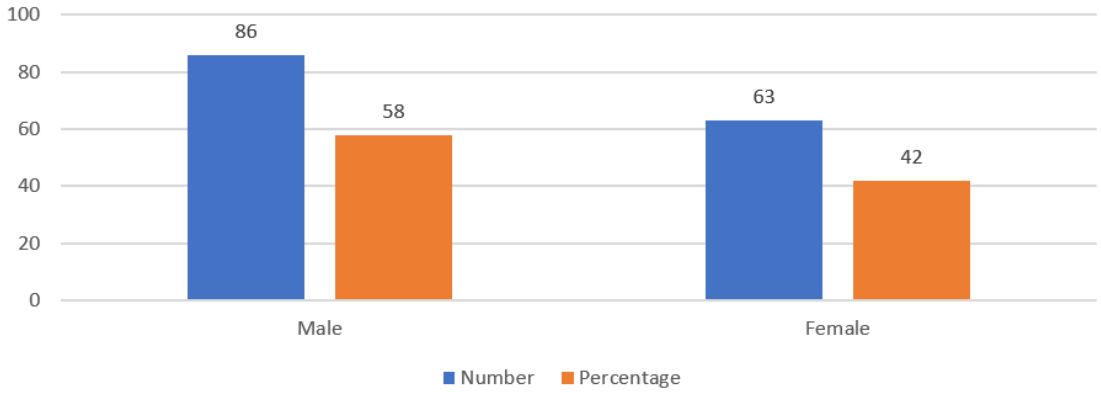

Figure 2. Breakdown of patients with urinary tract infections by sex.

This Figure 2 shows that of the 149 patients with urinary tract infections, males are more represented in our population with 86 cases, i.e. a prevalence of 58%, compared with 63 cases in females with 42%, which is contrary to the literature where females are more exposed than males.

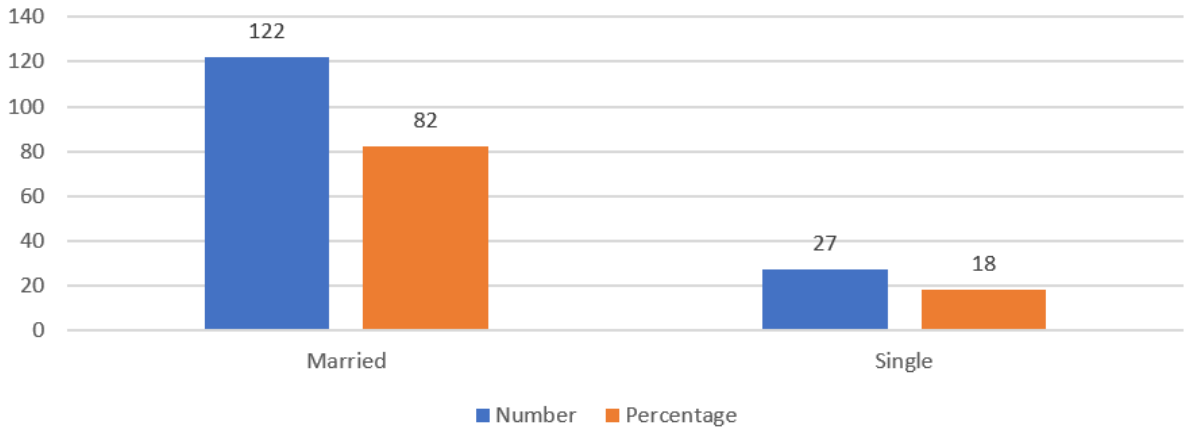

Figure 3. Breakdown of patients with urinary tract infections by marital status.

This Figure 3 shows that of the 149 patients with urinary tract infections, married people are the most represented in our population, with 122 cases, a prevalence of 82%, compared with only 27 cases among unmarried

people, with 18%. The high prevalence among married patients could be explained by their frequent sexual relations and polygamy.

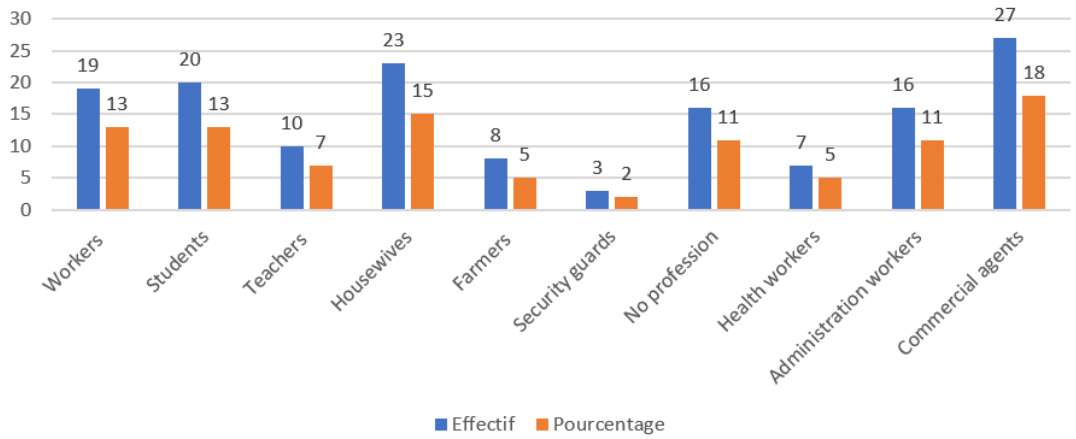

Figure 4. Breakdown of patients with urinary tract infections by Socio-professional category.

The Figure 4 shows that all socio-professional groups are affected by urinary tract infections. Of the 149 patients with urinary tract infections, shop assistants were the most common, with 27 cases (18%), followed by housewives (15%), pupils/students (13%), administrative staff and those with no profession (11% each). Security guards were the least represented, with 2%. The high prevalence among the former indicates a lack of personal hygiene and ignorance of the mode of contamination.

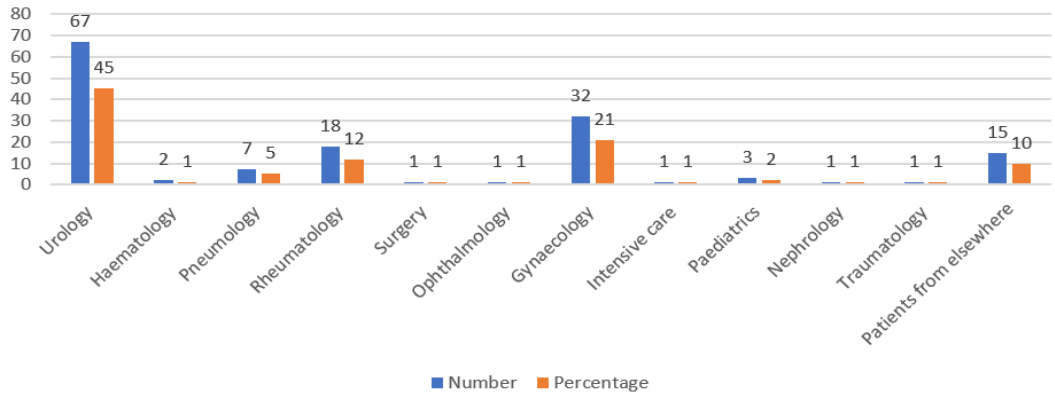

Figure 5. Breakdown of patients with urinary tract infections by requesting department.

This Figure 5 shows that of the 149 patients with urinary tract infections, married people are the most represented in our population, with 122 cases, a prevalence of 82%, compared with only 27 cases among unmarried people, with 18%. The high prevalence among married patients could be explained by their frequent sexual relations and polygamy.

In this Figure 6, we see that of the 149 patients with urinary tract infections, patients from the Commune of Kaloum are the most represented, with 53 cases, or 36%, followed by those from elsewhere (outside Conakry), or 20%. Patients with urinary tract infections from the Commune of Matam accounted for 19%, and those from the Commune of Dixinn for 12%. Conakry's two largest communes were the least represented, with 9% of patients from Ratoma Commune and 4% from Matoto Commune.

This high prevalence in the commune of Kaloum is undoubtedly due to the proximity of the University Hospital Center Ignace Deen to the people of Kaloum commune, where the health facility is located.

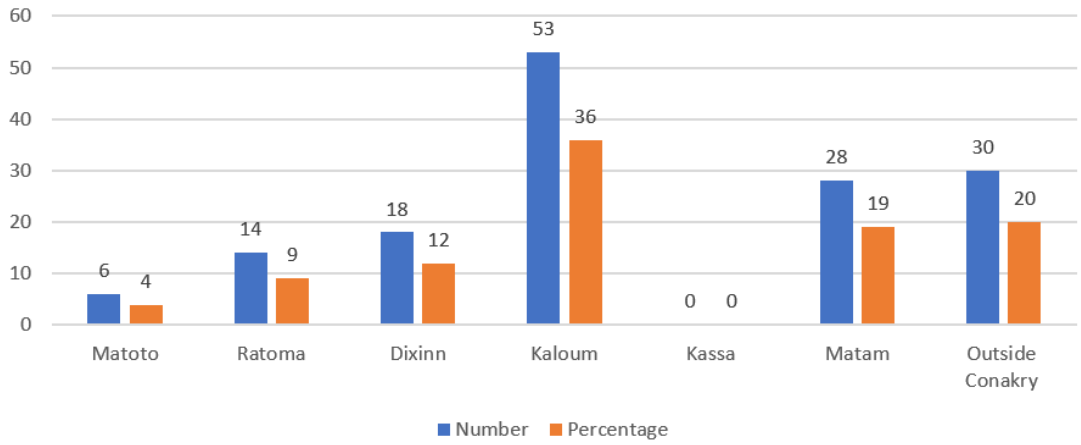

Figure 6. Breakdown of patients with urinary tract infections by place of residence.

Note: Outside Conakry: Patients from Coyah, Dubréka, Kindia, Forécariah, Boké and Mamou.

4. DISCUSSION OF THE RESULTS

4.1. Socio-Demographic Characteristics

The marital status of patients shows that married people are by far the most exposed to urinary tract infections , with a prevalence of 78%. Housewives are the most represented, with 30%, followed by administrative staff with 19%, and patients with urinary tract infections from the commune of Ratoma are the most represented, with 35%. The total number of cases was 86, i.e. a prevalence rate of 58%, compared with 63 cases among women (42%), which is contrary to the literature, where women are more exposed than men.

A breakdown of patients by sex showed that 58% (86/149) were male, compared with 42% (63/149) female. The sex ratio (male/female) was 0.73 (Figure 2). These rates are contrary to those reported in Morocco by Ismaël in his doctoral thesis in medicine, with 56.51% women and 43.49% men [9]. Numerous other studies on uropathogenic E. coli show that females generally predominate because of their anatomical structure, due to the proximity of the anus and the urinary meatus [1, 7, 8]. Another reason for the lower incidence of uropathogenic E. coli in men than in women is the antibacterial property of prostatic fluid [7].

A breakdown of patients by age showed that the 51+ age group was the most affected (32%), followed by the 21-30 age group (19%) and the 31-40 age group (16%). The age groups least represented were 11-20 and 0-10, with 5% and 6% respectively (Figure 1). This could be explained by the fact that the frequency of urogenital infections increases with age. In the literature, this observation has been made by other authors [1, 7].

In terms of marital status, married couples are by far the most affected by urinary tract infections, with 82% compared with 18% of unmarried couples. The married/single ratio is 4.5 (Table 3). This may be due to intense sexual intercourse, pregnancy or other situations such as anatomical and physiological factors in women that favour the establishment of germs [8]. Otherwise, sexual activity is quite normal and frequent in married couples. This is justified by the social and religious conditions and the traditional context in Guinea.

From the point of view of socio-professional categories, urinary infections are encountered in all socio-professional strata. However, housewives were the most represented in this study, with 15% (23/149), followed by commercial workers with 18% (27/149) and pupils/students with 13% (19/149) (Table 4).

In terms of requesting departments, all departments were represented, but the prevalence remained high among patients from the Urology department with 45% (67/149), followed by Gynaecology with 21% (32/149), Rheumatology with 12% (18/149) and patients from elsewhere with 10% (15/149).

In terms of residence, patients with urinary tract infections from the commune of Kaloum were the most represented with 36% (53/149), followed by patients from outside Conakry with 20% (30/149) and 19% (28/149).

With regard to the macroscopic appearance of the 228 urine samples of the patients examined, 61% were clear (140/228), turbid urine represented 33% (75/228) and haematic urine represented 6% of the samples (13/228) (Table 1). Cloudy urine means that it is potentially infected.

Microscopic analysis showed that 15% of the urine was germ-free (26/175), compared with 63% containing gram-negative bacilli (94/149) and gram-positive cocci (37%). According to cytology, leucocyturia was significant in 86% (151/175) of infected urine samples. Epithelial cells were present in 6%, haematuria in 3%, yeast in 3% and oxalate crystals in 2%.

In terms of the prevalence of urinary tract infections, the results showed that 85% of patients actually suffered from urinary tract infections (149/175) compared with 15% of patients who had no urinary tract infection (26/175) (Figure 4).

The distribution of infected urine according to the germs involved shows that E. coli is the most common germ, accounting for 40% (61/149), followed by *Staphyloccus aureus* with 32% (47/149), *Klebsiella pneumoniae* with 8% (12/149), *Pseudomonas aeruginosa* with 5% (8/149), *Acinetobacter baumannii* with 3% (4/149) and *Staphylococcus haemolyticus* with 2% (3/149) and the other germs are poorly represented with 1% (Figure 5).

4.2. Antibiotic Susceptibility of Isolated Uropathogenic Germs

The results of our study showed that the bacteria isolated were sensitive to Amikacin (63%), Gentamicyne (3%) and Tobramycin (39%). This sensitivity of certain germs to Amikacin is due to the fact that aminosides are antibiotics with a broad spectrum of activity and a significant bactericidal effect, which are major advantages (Table 6). The very low sensitivity of germs to quinolones. Nalidixic acid (13%), Ciprofloxacin (31%) and Ofloxacin (13%) (Table 7). The Nitrofurans class was represented by a single antibiotic, Nitrofurantoine, whose germs were sensitive to 79% of the samples analysed and resistant to 7%. NIT reacts very well with germs (Table 8). Trimethoprim/Sulfamethoxazole did not prove effective against the germs isolated from the 149 patients, as TMP-SMX was resistant in 105 patients (71%) (Table 9). Clindamycin was not effective against germs in 90% of cases with undetermined susceptibility (Table 10). Macrolides were not effective against the germs and represented 130 cases of undetermined sensitivity for Erythromycin, i.e. 87%, and 132 cases for Quinupristin, i.e. 88% (Table 11). Very few germs were sensitive to Linezoide antibiotics, with undetermined sensitivity accounting for 115 cases, or 77% (Table 12).

The Glycopeptide family is represented by a single antibiotic, Vancomycin. Of the germs isolated from the 149 patients, Vancomycin was not effective in the vast majority, i.e. 77% of undetermined susceptibility. However, sensitivity was observed in 15 cases, i.e. 10%, and 20 cases of resistance, i.e. 13% (Table 13). In the β- Lactam family, high susceptibility to Imipenem (76%), Cefotaxime (67%) and Ertapenem (64%) was observed. On the other hand, resistance to Ampicillin was 72%, Ticarcillin 70% and Ceftazidime 61%. This resistance could be due to the bio-resistance of E.coli and other germs involved in UTIs to the two antibiotics, thus limiting their use in antibiotic therapy for urological diseases (Table 14).

Our results are comparable to those of several Authors who have reported high susceptibility of Extended-spectrum beta-lactamases (ESBLs) producing uropathogenic E. coli to carbapenems (imipen and ertapen) in beta-lactamase-producing uropathogenic ESBL strains [1, 8, 10]. The carbapenem susceptibility of uropathogenic E. coli strains found in this present work is comparable to that reported in Mexico by Ramírez-Castillo, et al. [11]. Rezai, et al. [10] reported that most ESBL-producing uropathogenic *E. coli* strains were susceptible to carbapenems [10]. The beta-lactam susceptibility of the majority of *E. coli* studied in the present work is broadly comparable to that reported by some authors [1, 10].

The strains studied in this study were generally resistant to ampicillin, ticarcillin and ceftazidime. This resistance could be due, on the one hand, to the fact that these molecules (in particular ampicillin) are abused in the Republic of Guinea and, on the other hand, to the fact that most of these strains are ESBL producers. The results of

these authors point in the same direction. Indeed, Shahbazi, et al. [12] in their studies, found that a higher number of ESBL-producing uropathogenic E. coli were resistant to amino glycosides and quinolones compared to uropathogenic E. coli strains that do not produce ESBL [13]. The results of Bartoletti, et al. [14] and Idil, et al. [13], showed that Carbapenems (Imipenem and Meropenem) represented the best option for the treatment of urinary tract infections caused by ESBL-producing strains [12, 14]. However, Makanéra, et al. [15] found that Cephalosporins, Penicillins and Monobactams should be used with β-lactamase inhibitors [15].

In Tanne [16] showed that ESBL-producing E. coli isolates are also resistant to other antimicrobial agents, such as aminoglycosides, tetracycline and Trimethoprim/Sulfamethoxazole [16].

The results of several authors such as Gajdács, et al. [17], reported lower resistance (around 34%) to Imipenem and Meropenem in India [17], Malaysia [18], Colombia, Saudi Arabia [19] and Iran [20-22]. Although we found Carbapenems to be the most effective agent against ESBL, the high rate of resistance, compared with other studies, remains of great concern. Recently, the study by Alikhani and al. in Iran showed a sensitivity of 75% of ESBL pathogens to Carbapenems [8]. The main reason for the large difference in resistance rates between different countries and different regions within the same country is due to the intensive use of broad-spectrum antibiotics, particularly third-generation Cephalosporins, and the persistence of resistant strains in healthcare establishments. Extensive use of broad-spectrum antibiotics, particularly third-generation Cephalosporins.

In our study, we found that antibiotics such as Amikacins, Gentamycins, Nitrofurans, Imipenems, Ertapenems and Cefotaximes were very active on the germs isolated. Indeed, the strains isolated were generally sensitive to amikacin (63%), nitrofuran (79%), Imipenems (76%), Ertapenem (64%) and Cefotaxime (67%).

These results differ from those found in India by Shahid, et al. [22] in terms of the frequency of sensitivity to aminoglycoside antibiotics [22]. These authors reported that the E. coli strains analysed in their study were 57.1% sensitive to amikacin, followed by tobramycin at 38.5% and gentamicin at 31.9%. This shows that these molecules were more active on the E. coli strains in this study than those of these authors. However, in our study, the sensitivity frequencies of E. coli strains to aminoglycosides showed that amikacin was more active than gentamicin, and the latter more active than tobramycin. Conversely, the resistance phenotype detected in E. coli strains was generally weaker, and the phenotypic resistance detected is mainly as follows: Gentamicin, Tobramycin, Netilmicin and Amikacin resistance.

The majority of strains isolated were fairly resistant to quinolones. In our study, 59% of strains were resistant to nalidixic acid, 49% to ciprofloxacin and 60% to ofloxacin.

These results are comparable to those of other authors. Indeed, Akya, et al. [23] reported the metadata of 53 studies on uropathogenic E. coli strains performed between 2001 and 2011 on quinolones [23]. The compilation of these data showed high resistance of uropathogenic E. coli to these molecules. The overall resistance of strains isolated to nalidixic acid, ciprofloxacin, norfloxacin and ofloxacin was 42.3%, 28.2%, 48.5% and 24.1% respectively [23].

5. CONCLUSION

At the end of our research on the sensitivity profile of uropathogenic germs, we came to the following conclusion: Of 228 urine samples analysed, the macroscopic aspect showed that 140 were clear, i.e. 61%, 75 patients had cloudy urine, i.e. 33%, and haematic urine represented 6% of the sample. Microscopic analysis showed that 140 urines were germ-free, i.e. 61%, while 88 urines contained gram-negative bacilli, i.e. 30%, and gram-positive cocci, i.e. 9%.

Our results showed that urogenital infections were caused mainly by *Escherichia coli*, with a high prevalence of 40%, followed by Staphylococcus aureus with 32%. Amikacin, Nitrofuran, Imipenems, Ertapenem and Cefotaxime appear to be the antibiotics of choice for first-line treatment of urogenital infections in our series.

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Institutional Review Board Statement: The Ethical Committee of the Gamal Abdel Nasser University of Conakry, Guinea has granted approval for this study (Ref. No. UGANC/RECT. 0056/06/2020).
Transparency: The authors state that the manuscript is honest, truthful, and transparent, that no key aspects of the investigation have been omitted, and that any differences from the study as planned have been clarified. This study followed all writing ethics.
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