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Antibiotic sensitivity pattern of isolated batteries in urinary tract infections in patients attended at Hospital Central de Maputo, Mozambique

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ABSTRACT

Focused researcher investigating the epidemiology and antibiotic resistance patterns of urinary tract infections (UTIs) at Maputo Central Hospital, Mozambique, from 2019 to 2020. Specialized in evaluating empirical treatment strategies and antimicrobial susceptibility profiles to optimize patient outcomes. Dedicated to advancing evidence-based practices through comprehensive antibiogram analysis, guiding effective antibiotic therapy selection. Committed to addressing the challenge of antibiotic resistance in UTIs, critical for improving treatment protocols and patient prognosis in healthcare settings.

Keywords: Urinary tract infections, antibiotic resistance, epidemiology, empirical treatment, antimicrobial susceptibility

INTRODUCTION

Urinary tract infections (UTI) are one of the main causes of consultations in medical practice and one of the important problems that pose a challenge to health services in many countries, not only due to their high prevalence, but also due to the high costs of their treatment, second only to respiratory infection. Urinary tract infections are defined as the invasion of the urinary system by bacteria and occasionally fungi, parasites or viruses, triggering an inflammatory response in the affected structures.

UTIs are generally classified according to location and the presence of complications. Thus, when the infection only affects the lower tract, it is classified as low UTI (cystitis), and if the lower and upper tracts are affected simultaneously, it is classified as high UTI (pyelonephritis).

UTIs can occur in all populations regardless of sex or age group, being more frequent in children under 6 months of age, sexually active young women, during pregnancy and in elderly people over 60 years of age.

The prevalence of UTI is higher in the female population. Epidemiological studies have shown that one in three women will have a UTI at some point in their lives. This fact is attributed to the proximity between the vulva and the anus and the short length of the urethra, which makes them susceptible to these infections.

Studies carried out in some African countries show similarity in the prevalence of urinary infections, where Libya has a prevalence of 13.9%, Nigeria 13% and Ethiopia 9.2%.

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gram negative bacilli , with a prevalence rate of 70 to 90%, with *Escherichia coli being* the most isolated etiological agent, followed by *Klebsiella spp* and, on the other hand, if gram positive bacteria represented by *Staphylococcus saprophyticus* with a prevalence of 15%. The diagnosis of UTI depends on proof of significant batteryuria , obtained through urine culture examination. quantitative.

Treatment must be individualized according to the patient's pathology and clinical conditions, but its basic pillars are the introduction of antibiotics and immediate drainage of the urinary tract. Fluoroquinolones are the drugs of choice, with options also being penicillins with b-lactamases inhibitors , aminoglycosides , second and third generation cephalosporins , with treatment time varying between 7 and 14 days.

The classes of antibiotics most used in Mozambique belong to the Penicillins and Cephalosporins class with b- lactamase inhibitors , Macrolides , Quinolones , Tetracyclines, Aminoglycosides and Sulfamides and Trimethoprim; However, antibiotics administered frequently, for example, in outpatients, such as trimethoprim and sulfamethoxazole , ciprofloxacin and amoxicillin have a considerable resistance profile. This fact raised the need to provide scientific evidence that attracts the attention of clinicians and makes it possible to update the treatment guide in use in other health units in the country.

In Mozambique, the use of broad-spectrum antibiotics for the treatment of various infections, including urinary tract infections, is very common, and they are generally used for empirical treatments, which leads to the emergence of bacteria resistant to the action of antibiotics.

Choosing treatment with an appropriate antimicrobial is a challenge for healthcare professionals, due to the growing number of resistant microorganisms.

Most cases of uncomplicated UTI are treated empirically with broad-spectrum antibiotics, and all antibiotics prescribed in the community are used to treat UTIs , which amounts to overuse. The progression of antibiotic resistance increases the emergence of multidrug-resistant infections that are difficult and costly to treat, and because it is irreversible or very slow to reverse, it is particularly worrying.

Antibiotic resistance represents a complex problem resulting from multiple factors, including the indiscriminate use of antibiotics. This is a serious global problem that affects both developed and developing countries.

Empirical treatment may vary between certain regions, as it is based on the prevalence of the agent and local antimicrobial resistance. Error in choosing the antimicrobial can lead to resistance of some bacteria, or even the death of the patient. In view of this, the importance of monitoring is highlighted, through antibiograms, which serve as a guide for choosing the appropriate treatment in order to offer a better prognosis to the patient. Thus, antibiotic sensitivity testing is an essential tool for monitoring the resistance and susceptibility profile of microorganisms that cause UTIs. The results of the study serve as a

basis for monitoring and evaluating the trend of antibiotic resistance at Hospital level and evaluating the effectiveness of antibiotics used to treat urinary infections.

GOAL

The study aimed to understand the antibiotic sensitivity pattern of bacteria isolated in urinary tract infections in patients treated at the Maputo Central Hospital - Mozambique in the period from 2019 to 2020.

METHODOLOGY

Urine culture record books that showed bacterial growth in the period from 2019 to 2020. Participants were selected through systematic random probabilistic sampling.

The data were collected from the record books of the Microbiology Laboratory of the Maputo Central Hospital, and were subsequently entered into the *Microsoft Excel spreadsheet*.

Data analysis was carried out using the *Epi statistical program info* version *7.2.3.1*.

The association of antibiotic resistance of the isolated bacteria and the origin of the sample was determined using the chi-square test with a significance level of 5% ($\alpha = 0.05$), therefore the association of the two variables was considered if the p-value $\leq \boldsymbol{\alpha}$. The study respected the ethical principles for clinical research, the research protocol was approved by the Sofala Interinstitutional Bioethics Committee with number 024/CIBS/2022.

RESULTS

DEMOGRAPHIC RESULTS

The study consisted of 197 positive urine culture samples, 121 (61.4%) from female patients (the majority) and 76 (38.6%) from males.

Regarding the origin of the samples, 92 (46.7%) were from outpatients and 105 (53.3%) from patients admitted to various services.

With regard to samples from hospitalization, most were from the Medicine wards 42 (21.3%) and Pediatrics 41 (20.8%). For more details see Table 1.

Regarding age, it was found that the minimum age was 1 year and the maximum age was 91 years. The average age was 34 years, with a median of 34 years and a mode of 1 year. 25% of patients were under 14 years of age, half of patients were under 34 years of age, and 75% were under 55 years of age.

Table 1: Distribution of patients according to sex and origin. *Others (Surgery, Urology, Gastroenterology, Dermatology, Clinic, Neurology and Aid Bank)

Provenance		GENDER				TOTAL	
		Masculine		Feminine			
		Absolute	%	Absolute	%	Absolute	%
	Outpatient	32	34.8	60	65.2	92	46.7
Hospitalized	Medicine	13	30.9	29	69.1	42	21.3
	Pediatrics	24	58.5	17	41.5	41	20.8
	Obstetrics	0	0	11	100	11	5.6
	Others*	7	63.6	4	36.4	11	5.6
	TOTAL	76	38.6	121	61.4	197	100

Source: Prepared by the author based on Epi info *version 7.2.3.1* and Microsoft Excel 2013

COMMON BACTERIA

During the period under analysis (2019 - 2020) and using systematic random probabilistic sampling, 197 positive urine culture results were selected , where there was growth of gram negative and positive bacteria, with greater emphasis on gram negative bacteria belonging to the *Enterobacteriaceae family.* (88.32%), where the highest frequency was recorded for *Escherichia coli* (43.15%), *Klebsiella sp* (21.32%), *Enterococcus sp* (10.15%) and *Enterobacter sp* (9.14%), as shown in Table 2.

Table 2: Distribution of isolates in relation to provenance. *Others (Acinetobacter sp, Citrobacter sp, Proteus sp, Pseudomona aeroginosa, Sptreptococus spp, Staphylococcus saprophyticus)

Isolated		Provenance				TOTAL	
		Outpatient		Internment			
		Absolute	%	Absolute	%	Absolute	%
	Escherichia coli	52	56.52	33	31.4	85	43.15
Isolated	*Klebsiella sp*	15	16.3	27	25.7	42	21.32
	Enterococcus sp	5	5.43	15	14.3	20	10.15
	Enterobacter sp	5	5.43	13	12.4	18	9.14
	Others*	15	16.32	17	16.2	32	16.24
	TOTAL	92	100	105	100	197	100

Source: Prepared by the author based on Epi info *version 7.2.3.1* and Microsoft Excel 2013

Antibiotic sensitivity profile of common bacteria

Antibiotic sensitivity profile of *Escherichia coli*

In relation to *Escherichia coli,* high resistance rates were recorded for Ampicillin (90.5%), Cotrimoxazole (66.7%) and Naldixic Acid (57.9%). The highest sensitivity rates were recorded for Imepenem (94.9%), Amikacin (87.9%) and Nitrofurantoin (84.2%). For more details see Table 3.

Table 3: Description of the antibiotic sensitivity profile of *E. coli*

	Antibiotics	Isolated	TSA Result		
			Intermediary (%)	Resistant (%)	Sensitive (%)
Escherichia coli	Naldixic acid	69	5.8	57.9	36.3
	Amikacin	33	3	9.1	87.9
	Amoxicillin	9	0	33.3	66.7
	Amoxicillin / Clavulanic Acid	50	20	40	40
	Ampicillin	63	0	90.5	9.5
	Cefotaxime	15	6.7	40	53.3
	Cefoxitin	50	6	18	76
	Ceftazidime	64	4.7	25	70.3
	Ceftriaxone	55	0	38.2	61.8
	Cotrimoxazole	21	0	66.7	33.3
	Ciprofloxacin	48	4.2	50	45.8
	Gentamicin	20	5	30	65
	Imepenem	78	1.2	3.9	94.9
	Nitrofurantoin	76	2.6	13.2	84.2

Source: Prepared by the author based on Epi info *version 7.2.3.1* and Microsoft Excel 2013

Klebsiella antibiotic sensitivity profile *sp*

Of the antibiotics tested for isolates of the genus *Klebsiella* , most of them registered high rates of resistance, most notably to Ampicillin (100%), Cotrimoxazole (90.9%), Norfloxacin (80%), Amoxicillin / clavulanic acid (60.9%), Ceftazidime (60.6%), Cefotaxime (60%), Ceftriaxone (57.1%), Naldixic Acid (56.3%) and the most effective drugs were: Imepene (93.8%), Amikacin (85.7%), Cefoxitin (64%), as shown in table no. 4.

Table 4: Description of the antibiotic sensitivity profile of *Klebsiella spp*

	Antibiotics	Isolated	TSA Result		
			Intermediary (%)	Resistant (%)	Sensitive (%)
Klebsiella spp	Naldixic acid	32	6.3	56.3	37.5
	Amikacin	14	7.2	7.1	85.7
	Amoxicillin	3	0	100	0
	Amoxicillin / Clavulanic Acid	23	8.7	60.9	30.4
	Ampicillin	28	0	100	0
	Cefotaxime	5	0	60	40
	Cefoxitin	25	16	20	64
	Ceftazidime	33	15.2	60.6	24.2
	Ceftriaxone	28	0	57.1	42.9
	Cotrimoxazole	11	0	90.9	9.1
	Ciprofloxacin	25	24	52	24
	Gentamicin	11	9	45.5	45.5
	Imepenem	32	3.1	3.1	93.8
	Levofloxacin	0	0	0	0
	Nitrofurantoin	35	11.4	37.1	51.4
	Norfloxacin	5	0	80	20

Source: Prepared by the author based on Epi info *version 7.2.3.1* and Microsoft Excel 2013

Antibiotic sensitivity profile of *Enterococcus sp*

For species of the genus Enterococcus, high resistance rates were recorded for Ciprofloxacin (100%), Gentamicin (71.4%) and Ampicillin (66.7%). For this genus, antibiotic efficacy was recorded for Nitrofurantoin (55.6%) (see Table 5).

Table 5: Description of the antibiotic sensitivity profile of *Enterococcus sp*

	Antibiotics	Isolated	TSA Result		
			Intermediary (%)	Resistant (%)	Sensitive (%)
Enterococcus sp	Naldixic acid	1	0	100	0
	Amikacin	1	0	0	100
	Amoxicillin	two	0	50	50
	Amoxicillin / Clavulanic Acid	0	0	0	0
	Ampicillin	15	0	66.7	33.3
	Cefotaxime	1	0	0	100
	Cefoxitin	1	0	0	100
	Ceftazidime	0	0	0	0
	Ceftriaxone	1	0	0	100
	Cotrimoxazole	1	0	100	0
	Ciprofloxacin	14	0	100	0
	Gentamicin	7	0	71.4	28.6
	Imepenem	1	0	0	100
	Levofloxacin	0	0	0	0
	Nitrofurantoin	18	11.1	33.3	55.6
	Norfloxacin	0	0	0	0

Source: Prepared by the author based on Epi info *version 7.2.3.1* and Microsoft Excel 2013

Enterobacter antibiotic sensitivity profile *sp*

The isolates of the genus *Enterobacter* showed high rates of resistance mainly to Ampicillin (91.7%), Amoxicillin / Clavulanic Acid (88.8%), Ceftriaxone (77.8%), Naldixic Acid (73.3%), Ciprofloxacin (69.2**%)** and Ceftazidime (66.7%). With regard to antibiotic sensitivity, antibiotic efficacy was recorded for Amikacin (100%), Imepenem (100%) and Cefoxitin (80%), as shown in Table 6.

Table 6: Description of the antibiotic sensitivity profile of *Enterobacter sp*

	Antibiotics	Isolated	TSA Result		
			Intermediary (%)	Resistant (%)	Sensitive (%)
Enterobacter sp	Naldixic acid	15	6.7	73.3	20
	Amikacin	6	0	0	100
	Amoxicillin	3	33.3	66.7	0
	Amoxicillin / Clavulanic Acid	9	0	88.8	11.2
	Ampicillin	12	0	91.7	8.3
	Cefotaxime	2	0	50	50
	Cefoxitin	10	20	0	80
	Ceftazidime	15	0	66.7	33.3
	Ceftriaxone	9	0	77.8	22.2
	Cotrimoxazole	3	0	66.7	33.3
	Ciprofloxacin	13	15.4	69.2	15.4
	Gentamicin	0	0	0	0

	Imepenem	14	0	0	100
	Levofloxacin	0	0	0	0
	Nitrofurantoin	17	5.9	52.9	41.2
	Norfloxacin	1	0	100	0

Source: Prepared by the author based on Epi info *version 7.2.3.1* and Microsoft Excel 2013

ANTIBIOTIC RESISTANCE OF ISOLATED BACTERIA IN RELATION TO SAMPLE ORIGIN

To verify the association of antibiotic resistance of the isolated bacteria in relation to origin, the patient's origin was defined as the exposure variable, where hospitalization is the variable with exposure and outpatient care without exposure. Antibiotic resistance was considered as an outcome variable. The significance level defined was 5% (α = 0.05).

Interpretation of the result

Based on *Epinfo,* the chi-square was calculated by crossing the provenance variables (exposure variable) and antibiotic used in the sensitivity test (result variable) and the following result was obtained: For Naldixic Acid (*p* = 0.11), Ampicillin (*p* = 0.29), Amoxicillin (F = 0.65), Cefoxitin (*p* = 0.29), Amoxicillin / clavulanic acid (p = 0.17), Gentamicin (*p* = 0.26), Imepenem (F = 0.09), Nitrofurantoin (*p* = 0.11), Cotrimoxazole (F = 0.15), presented proportions greater than 5% (*p* >0.05) and it can be stated that the antibiotic resistance of the isolated bacteria to these antibiotics is not associated with the origin of the sample. Paradoxically to this result , Amikacin (F = 0.05) , Ceftazidime (*p* = 0.00), Ceftriaxone (*p* = 0.00), Ciprofloxacin (*p* = 0.00) presented proportions equal to or below 5% (p ≤0.05), which allows us to state that the antibiotic resistance of the isolated bacteria to these antibiotics is associated with the origin of the sample. It is important to note that for cases in which the expected frequencies were less than 5, Fisher's exact test (F) was considered (see Table 7).

Table 7: Association of antibiotic resistance of isolated bacteria in relation to sample origin. X 2 – Significance level 5%; *Statistically significant association

	Antibiotic Tested				Antibiotic Tested		
Provenance	Ampicillin		Proportion (*P*)	Provenance	Amoxicillin / clavulanic acid		Proportion (*P*)
	R	s	0.29		R	s	0.17
Outpatient	53	8		Outpatient	31	21	
Hospitalized	62	5		Hospitalized	30	11	
	naldixic acid		Proportion (*P*)		Cotrimoxazole		Fisher test (F)
	R	s	0.11		R	s	0.15
Outpatient	40	28		Outpatient	16	10	
Hospitalized	48	19		Hospitalized	13	two	
	Amoxicillin		Fisher test (F)		Ciprofloxacin		Proportion (*P**)
	R	s	0.65		R	s	0.00
Outpatient	4	6		Outpatient	27	24	
Hospitalized	6	4		Hospitalized	54	12	

	Amikacin		Fisher test (F *)		Gentamicin		Proportion (*P*)
	R	s	0.05		R	s	0.26
Outpatient	1	31		Outpatient	7	14	
Hospitalized	7	29		Hospitalized	12	12	
	Cefoxitin		Proportion (*P*)		Imepenem Test Fisher (F)		
	R	s	0.29		R	s 0.09	
Outpatient	12	36		Outpatient	8	67	
Hospitalized	17	32		Hospitalized	two	73	
	Ceftazidime		Proportion (*P**)		Nitrofurantoin		Proportion (*P*)
	R	s	0.00		R	s	0.11
Outpatient	20	46		Outpatient	23	55	
Hospitalized	45	24		Hospitalized	36	51	
	Ceftriaxone		Proportion (*P**)				
	R	s	0.00				
Outpatient	19	35					
Hospitalized	35	21					

Source: Prepared by the author based on Epi info *version 7.2.3.1* and Microsoft Excel 2013

DISCUSSION OF RESULTS

The highest frequency of bacteria causing urinary tract infections was found in female patients at 61.4%, in agreement with the results of Habte and Mohammed, where the prevalence of uropathogens in females was 65.4% and 60% respectively. UTIs are more common in females due to anatomical factors, such as the short urethra , which facilitates colonization by bacteria from the digestive tract, which ascend through the urethra and multiply in the urinary tract.

Regarding origin, most (53.3%) of the bacteria causing UTI were isolated from hospitalized patients, mainly in the Medicine and Pediatrics wards. These facts were observed in similar studies in which the prevalence of bacteria in hospitalized patients was 54.7%. These bacteria are mostly isolated from patients hospitalized in the Medicine and Pediatrics wards. Hospitalized patients may present high prevalence, especially associated with poor hygiene and catheterization.

Regarding the frequency of bacteria, it was found that the majority were Gram negative, belonging to the *Enterobacteriaceae family.* (88.32%), where the highest frequency was recorded for *Escherichia coli* (43.15%), *Klebsiella sp* (21.32%), *Enterococcus sp* (10.15%) and *Enterobacter sp* (9.14%), in line with results from Habte , who isolated *Escherichia coli* (39%), Klebsiella *spp* (20.8%) and *Enterococcus spp* (8. 2%).

The bacteria that dominated the bacteriological profile in this study was *Escherichia coli* with a frequency of 43.15%. Other results similar to this were obtained in studies by Iregbu & Nwajiobi-Princewill and Mohammed *et al.*, where *Escherichia coli* was isolated with prevalences of 37% and 55.6%

respectively. This bacterium is the most described in most studies on urinary tract infections, regardless of the characteristics of the populations.

The highest prevalence of *Escherichia coli* uropatogenica is associated with numerous virulence factors (α-hemolysin, cytotoxic necrosis factor, adhesins), as these factors support its ability to adhere to uroepithelial cells, helping to resist the bactericidal effect of serum and increasing the hydrophobicity of the cell surface, leading to tissue damage and also because it is present in the digestive tract , which ends up contaminating the urinary tract in poor hygiene conditions.

The results of this study showed that *Escherichia coli* presents high rates of resistance to Ampicillin (90.5%), Cotrimoxazole (66.7%) and Naldixic Acid (57.9%). Similar results were observed in the study by Monteiro ***et al.,*** where Ampicillin showed 86.7% and Naldixic Acid 55.6% resistance rate. In similar studies, Escherichia *coli* recorded 66.7% and 100% resistance rates for Naldixic Acid and Cotrimoxazole respectively

For isolates of the genus *Klebsiella* , high rates of antibiotic resistance were observed, most notably for Ampicillin (100%), Cotrimoxazole (90.9%), Amoxicillin / clavulanic acid (60.9%), Ceftazidime (60.6%), Cefotaxime (60%), Ceftriaxone (57.1%), a fact observed by Monteiro *et al.* in which in his study he recorded 93.9% for Ampicillin, 86% for Amoxicillin / Clavulanic acid , 51.1% for Ceftazidime and Cefotaxime, paradoxically to the results of the present study he recorded 34.4%. Meeren results *et al.* indicated a 100% resistance rate for *Klebsiella* isolates *sp* for the antibiotics Ceftazidime and Cefotaxime.

Ayoyi Study *et al*. demonstrated that *Escherichia coli* and *Klebsiella sp* present resistance profiles ranging from 64.7% to 90.6% for antibiotics such as: Ampicillin, Cotrimoxazole and Cefotaxime.
The study also showed that *Enterococcus sp* is resistance to Ciprofloxacin (100%), Gentamicin (71.4%) and Ampicillin (66.7%), in disagreement with the results of Goel, where Ciprofloxacin, Ampicillin and Gentamicin presented 68.8%, 36% and 32.7% respectively.

Ayoyi Research Report *et al.* demonstrated that *Enterococcus sp* presents high resistance rates ranging from 50% to 75% to Ceftazidime, Gentamicin, Cefotaxime and Cotrimoxazole.

For *Enterobacter sp* resistance was observed mainly for Ampicillin (91.7%), Amoxicillin / Clavulanic Acid (88.8%), Ceftriaxone (77.8%), Naldixic Acid (73.3%), Ciprofloxacin (69.2%) and Ceftazidime (66.7%), in contrast to Girma 's results *et al.*, where *Enterobacter sp* did not show resistance to Ceftriaxone , Gentamicin, Ciprofloxacin.

The high rates of resistance in isolated pathogens to antibiotics such as Amoxicillin , Cefotaxime, Ceftazidime, Ampicillin, Ceftriaxone, Naldixic Acid and Cotrimoxazole can be explained by the fact that these drugs are commonly used and generally empirically and also by the selective effect of the treatment of a patient with multiple antimicrobials.

Overall, the most effective antibiotics for all isolates in this study were : Nitrofurantoin (55.6% - 84.2%), Cefoxitin (64% - 80%), Amikacin (85.7% - 100%) and Imepenem (94.9% - 100%), the same result was reported by Iregbu *et al.* , in which the highest antibiotic sensitivity rate for isolated uropathogens is 98% for Amikacin, 97% for Imepenem and 78% for Nitrofurantoin. Mitiku *et al.* observed in his research that Imepenem has a high efficacy rate of around 96.2%, followed by Nitrofurantoin and Sulfamethoxazole-trimethoprim with 78.6% and 70.9% respectively.

Ayoyi Study *et al*. showed that *Escherichia coli* and *Klebsiella sp* present antibiotic sensitivity profiles for Ciprofloxacin , Naldixic Acid, Gentamicin , Ceftazidime and Imepenem, with percentages ranging from 55.3 to 100; While they pointed out in their studies that phosphomycin (98.3%), Cefotaxime (95%), Ciprofloxacin (93.9%), Levofloxacin (93.9%), Imipenem (98.5%), Meropenem (91%) and Norfloxacin (89.7%) as recommended antibiotics for the treatment of UTI.

Harrison *et al*., suggest the use of ampicillin , gentamicin , quinolone , ceftriaxone , Imepenem for the treatment of complicated UTIs in men and women, caused by *E. coli, Proteus mirabilis and Klebsiella pneumoniae, Pseudomonas sp, Serratia sp, Enterococci and Staphylococci sp, with mild to* moderate symptoms.

The study showed that the antibiotic resistance of the bacteria isolated in relation to Amikacin (p = 0.05), Ceftazidime (p =0.00), Ceftriaxone (p = 0.00), Ciprofloxacin (p = 0.00) is associated with the origin of the sample according to the chi-square test ($p \leq 0.05$) . These results converge with the findings by Monteiro *et al.* , in relation to Amikacin (p =0.04) and Ceftazidime (p =0.00), where the chi-square result for these drugs showed that the antibiotic resistance of the isolated bacteria and the patient's origin present a statistically significant association.

FINAL CONSIDERATIONS

Urinary tract infections are common in female patients.

UTIs are more frequent in hospitalized patients, especially in Medicine and Pediatrics wards.

The bacteriological profile was dominated by *Escherichia coli* (43.15%) in all UTIs diagnosed at HCM, mainly in outpatients, thus standing out as the main agent of community and nosocomial infections.

Antibiotics such as: Ampicillin, Cotrimoxazole, Naldixic Acid, Amoxicillin / Clavulanic Acid, Ciprofloxacin, Gentamicin, Ceftazidime, Cefotaxime, Ceftriaxone showed low efficacy for the treatment of UTIs because they presented high rates of antibiotic resistance for all isolates.

The results of this study show that high rates of resistance to 3rd generation Cephalosporins (Ceftazidime, Cefotaxime, Ceftriaxone) and common antibiotics may be associated with the presence of multi-drug strains in the hospital environment and indiscriminate use of antibiotics.

In general, the highest rates of antibiotic sensitivity were recorded for Imepenem, Amikacin,

Nitrofurantoin and Cefoxitin, which shows that these drugs are the best alternatives for treatment of UTIs in outpatients and inpatients.

The study showed that the antibiotic resistance of isolated bacteria in relation to Amikacin, Ceftazidime, Ceftriaxone, Ciprofloxacin and the origin of the sample presents a statistically significant association according to the result of the chi-square test ($p \leq 0.05$).

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