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Perfil de susceptibilidad antimicrobiana de enterobacterias causantes de infección de tracto urinario en pacientes ambulatorios Loja- Ecuador

Antimicrobial susceptibility profile of enterobacteria causing urinary tract infection in outpatients of the Loja- Ecuador.

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Palabras claves:
Enterobacteriaceae
Infecciones urinarias
Antimicrobianos
Betalactamasas
Resistencia microbiana a antibióticos

Resumen

La infección del tracto urinario (ITU), se define como el crecimiento de microorganismos en cultivo de orina estéril en un paciente con síntomas clínicos compatibles o sin sintomatología. Siendo una causa frecuente de visitas al médico; y estas se encuentran entre las infecciones más prevalentes en la práctica clínica. Objetivo: Caracterizar el perfil de susceptibilidad antimicrobiana de Enterobacterias causantes de infección de tracto urinario en pacientes que acuden al laboratorio SER en Loja-Ecuador 2022. Métodos: Se utilizó el método observacional de tipo descriptivo, documental secundario. Se recopilaron los registros de urocultivos positivos para Enterobacterias, procedentes de pacientes que acudieron al laboratorio clínico SER de Loja entre enero - diciembre 2022, y se obtuvo una muestra de n= 229 registros. Para el análisis estadístico se generó una base de datos en el programa SPSS, se llevó a cabo mediante estadística descriptiva, y análisis de frecuencia. Resultados: En el presente estudio de los 229 casos válidos en estudio, el 87,8% corresponde al sexo femenino. Con respecto al grupo etario con más afectación fue el grupo correspondiente a la vejez (60 o más años) con el 44,54%. La especie bacteriana con mayor incidencia fue *Escherichia coli* con el 79,04%, *Klebsiella pneumoniae* con el 9,17%, *Proteus mirabilis* con el 4,80%, *Proteus vulgaris* 2,18%, *Citrobcter cloacae* con el 1,31%; *Edwarsiella spp, Klebsiella aerogenes, Pseudomona aeruginosa y Salmonella spp* con el 0,44% cada una, y *Morganella morganii y Serratia Marcescens* con el 0,87%. La producción de BLEE como mecanismo de resistencia predominaron en las cepas de *E.coli y Klebsiella pneumoniae*. Conclusión: El principal patógeno causante de infecciones de tracto urinario en pacientes que asisten al laboratorio SER de la ciudad de Loja es *Escherichia coli*, con mayor incidencia en el sexo femenino en el grupo etario vejez (60 o más años).

Keywords:
Enterobacteriaceae
Urinary tract infections
Antimicrobials
Beta-lactamases

Abstract

Urinary tract infection (UTI) is defined as the growth of microorganisms in sterile urine culture in a patient with compatible clinical symptoms or without symptoms. Being a frequent cause of visits to the doctor; and these are among the most prevalent infections in clinical practice. Objective: To charac-

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terize the antimicrobial susceptibility profile of Enterobacteriaceae that cause urinary tract infection in patients who attend the SER laboratory in Loja-Ecuador 2022. Methods: The descriptive, secondary documentary, observational method was used. Records of urine cultures positive for Enterobacteria were collected from patients who attended the SER clinical laboratory in Loja between January - December 2022, and a sample of n= 229 records was obtained. For the statistical analysis, a database was generated in the SPSS program, which was carried out using descriptive statistics and frequency analysis. Results: In the present study of the 229 valid cases under study, 87.8% corresponded to the female sex. Regarding the age group most affected, it was the group corresponding to old age (60 or older) with 44.54%. The bacterial species with the highest incidence was Escherichia coli with 79.04%, Klebsiella pneumoniae with 9.17%, Proteus mirabilis with 4.80%, Proteus vulgaris 2.18%, Citrobcter cloacae with 1.31%; Edwarsiella spp, Klebsiella aerogenes, Pseu-domona aeruginosa and Salmonella spp with 0.44% each, and Morganella morganii and Serratia Marcescens with 0.87%. ESBL production as a resistance mechanism pre-dominated in E. coli and Klebsiella pneumoniae strains. Conclusion: The main pathogen causing urinary tract infections in patients who attend the SER laboratory in the city of Loja is Escherichia coli, with a higher incidence in females in the old age group (60 or more years).

Introduction

Urinary tract infection (UTI) is defined as the growth of microorganisms in sterile urine culture in a patient with or without compatible clinical symptoms. It is a frequent cause of visits to the doctor and is among the most prevalent infections in clinical practice. UTIs are a frequently observed pathology with a major impact on healthcare costs. Commonly isolated bacterial agents are: Escherichia coli, Klebsiella spp. and Proteus spp.(1,2).

Antimicrobial resistance is of particular importance in the world. Gram-negative bacteria are a particular case due to the different resistance mechanisms reported to date. In this context, antibacterial therapy is difficult due to the ease of spread of multi-resistance and the absence of new antimicrobials active against these pathogens.(2–4).

In recent years, there has been a progressive increase in antibiotic resistance mechanisms. Among the beta-lactamases, ESBL, AmpC and carbapenemase types generate resistance

to third and fourth generation cephalosporins, monobactams and carbapenems respectively. For example, in ESBL-type beta-lactamases, the genes encoding these enzymes have been found worldwide mainly in Gram-negative bacteria, predominantly in the Enterobacteriaceae family.(5–8).

A study conducted in Havana, Cuba, reports that Escherichia coli continues to be the most frequently isolated microorganism in hospitalized patients, presenting seven resistance patterns with a variety of combinations. It is important to mention its high resistance to ciprofloxacin (70-83%), with 45% of strains resistant to 4 or more antimicrobial drugs. The treatment of urinary tract infections by multi-resistant germs represents a difficult therapeutic approach at present, due to a significant reduction in the sensitivity to antibiotics in circulating uropathogens, and a great variability in the resistance pattern.(9).

In Peru, the resistance profiles of uropathogenic Escherichia coli were compared and the phenotypes of extended-spectrum beta-lactamase-producing strains were identified in three private health facilities located in the coastal, mountainous and jungle regions. A descriptive study of 98 urine samples from patients with urinary tract infection was carried out in 2016, 35 from Lima (coastal), 38 from Juliaca (mountainous) and 25 from Iquitos (jungle). Antimicrobial sensitivity was determined using eight antibiotic discs. Eighteen resistance profiles were identified, ranging from those sensitive to all antibiotics to those simultaneously resistant to seven antibiotics, with 18.4% of isolates resistant to one antibiotic and 54.0% multi-resistant. Beta-lactamase production was detected in 28.6% of strains from the Puno region.(10).

In a study carried out in Ecuador in the city of Loja, the presence of extended-spectrum beta-lactamases and carbapenemases was detected in uropathogenic Enterobacterales isolated in the General Hospital "Isidro Ayora", Loja (Ecuador), during the period December 2017-July 2018. Of 323 isolated strains, 90 (27.86%) were producers of extended-spectrum beta-lactamases and 6 (1.86%) were positive for carbapenemases; Escherichia coli being the microorganism most frequently producing extended-spectrum beta-lactamases (77.08%) and Klebsiella pneumoniae of carbapenemases (4.16%).(11).

This research is novel, since in the city of Loja there is no updated information about the antimicrobial susceptibility profile of Enterobactaeria causing urinary tract infection. Users who go to the SER laboratory in Loja will benefit from this study since they will be able to access adequate antibiotic treatments and avoid the recurrence of UTIs; another benefit is for patients diagnosed with complicated infections, since prolonged treatment periods will be avoided. Also, the study will educate health professionals regarding the rational use of medications, as well as contribute to the monitoring of antimicrobial resistance (AMR).

For all the above, the purpose of this study was to characterize the antimicrobial susceptibility profile of Enterobacteria causing urinary tract infection in users who attend the SER laboratory in Loja- Ecuador 2022

Methodology

This study is based on the observational method of a descriptive, secondary documentary type. Regarding the time horizon of this study, it is cross-sectional since the data of the variables collected from the sample at a specific time of the study were analyzed; likewise, the research is descriptive, not experimental.

The study universe is made up of the group of users treated at the SER Clinical Laboratory of Loja between January - December 2022, there were 229 patients.

Methods and techniques for sample processing

Records of positive urine cultures for Enterobacteria were collected from patients who visited the SER clinical laboratory in Loja between January and December 2022, which totaled 229.

Processing, analysis, summary and presentation of information

Methods for isolating enterobacteria in urine cultures, recommended by the American Society of Microbiology, were used. For bacterial identification, a battery of biochemical tests was performed: lysine, citrate, urea, TSI, and SIM. Antimicrobial susceptibility, resistance mechanisms, and recording of inhibition zones were determined using the Kirby Bauer technique and in accordance with the CLSI 2022 document.

For statistical analysis, a database was generated in the SPSS program, which was carried out using descriptive statistics and frequency analysis. Tables and graphs were created to present the results.

All research is based on the Helsinki standards, which are based on ethical standards to preserve the dignity, confidentiality and integrity of the patient. The data were handled with strict confidentiality, through coding using a numerical system, the information was used only for the purpose of the research.

Results

In the present study of the 229 valid cases under study, 87.8% were female and 12.2% were male,**see figure**1.

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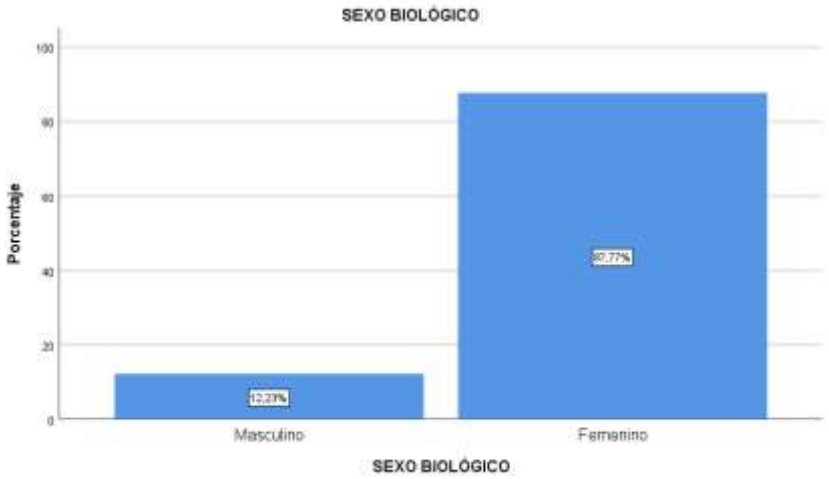

Figure 1: Percentage of urinary tract infections according to biological sex in the SER Loja laboratory – Ecuador, year 2022

Regarding the age group that presented a higher frequency of urinary tract infections, it was found that in the group corresponding to old age (60 years or older) they presented 44.54%, followed by adulthood (25 - 59 years) with 35.37%, early childhood (0 - 5 years) with 10.04%, youth (19 - 24 years) with 6.55%, childhood (6 - 11 years) with 3.06% and adolescence (12 - 18 years) with 0.44%, see figure 2.

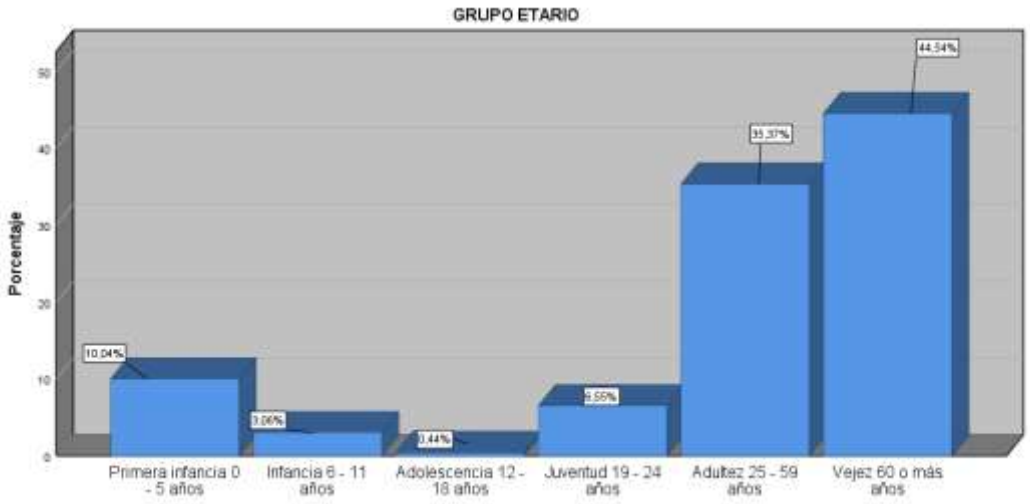

Figure 2. Percentage of urinary tract infections by age group in the SER Loja laboratory – Ecuador, year 2022

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Regarding bacterial species, the highest percentage was found to be Escherichia coli with 79.04%, Klebsiella pneumoniae with 9.17%, Proteus mirabilis with 4.80%, Proteus vulgaris 2.18%, Citrobcter cloacae with 1.31%; Edwarsiella spp, Klebsiella aerogenes, Pseudomona aeruginosa and Salmonella spp with 0.44% each, and Morganella morganii and Serratia Marcescens with 0.87%, see figure 3.

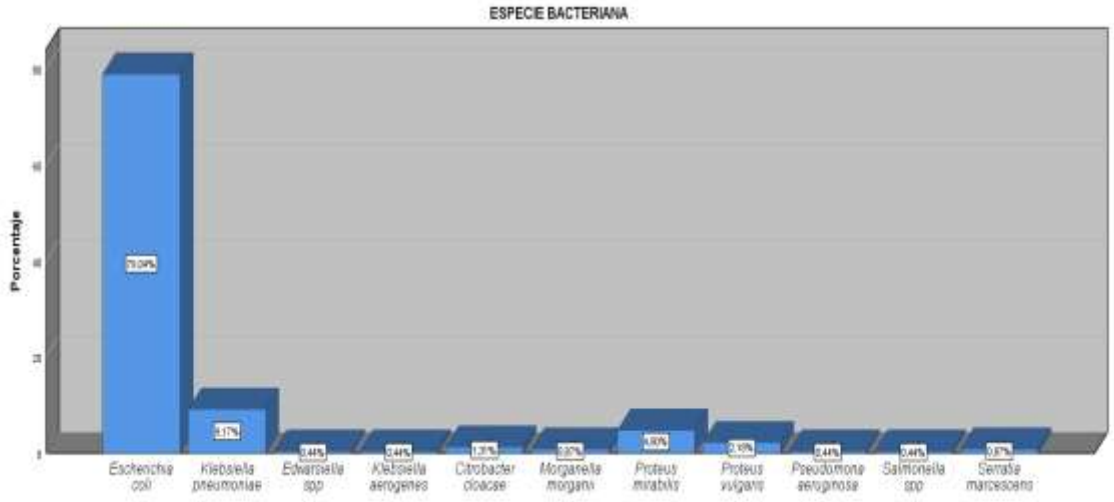

Figure 3: Most frequent bacterial species causing urinary tract infection in SER laboratory users Loja – Ecuador, year 2022

Antimicrobial susceptibility

Regarding antimicrobial susceptibility: Escherichia coli showed sensitivity to ceftriaxone (81.2%), cefepime (81.8%), meropenem (100%), imipenem (98.3%), fosfomycin (87.8%), piperacillin/tazobactam (92.3%), nitrofurantoin (91.2%), amikacin (97.8%), cefoxitin (84.5%), gentamicin (86.7%), amoxicillin+clavulanic acid (71.8%), cefuroxime (71.3%), ertapenem (100%), ciprofloxacin (54.7%), however it presents resistance to trimethoprim/sulfamethoxazole (56.4%); Klebsiella pneumoniae showed susceptibility to ceftriaxone (61.9%), cefepime (61.9%), meropenem (100%), imipenem (90.5%), piperacillin/tazobactam (66.7%), amikacin (90.5%), cefoxitin (61.9%), gentamicin (71.4%), amoxicillin+clavulanic acid (47.6%), ertapenem (100%), however it presents resistance to fosfomycin (47.6%), nitrofurantoin (47.6%), trimethoprim/sulfamethoxazole (61.9%), cefuroxime (52.4%), ciprofloxacin (57.1%); and Proteus mirabilis showed sensitivity to ceftriaxone (63.6%), cefepime (63.6%), meropenem (100%), imipenem (90.9%), fosfomycin (63.6%), piperacillin/tazobactam (90.9%), amikacin (90.9%), cefoxitin (81.8%), gentamicin (63.6%), amoxicillin+clavulanic acid (100%), cefuroxime (63.6%), ertapenem (100%), however it presents resistance to nitrofurantoin (90.9%), trimethoprim/sulfamethoxazole (72.7%) and ciprofloxacin (54.5%), see table 1.

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Table 1. Antimicrobial susceptibility profile of the main bacterial species causing urinary tract infections in users of the SER Loja laboratory – Ecuador, year 2022

		BACTERIAL SPECIES					
		Escherichia coli		*Klebsiella pneumoniae*		*Proteus mirabilis*	
		Count	Percentage %	Count	Percentage %	Count	Percentage %
Ceftriaxone	Sensitive	147	81.2%	13	61.9%	7	63.6%
	Interme-diate	0	0.0%	0	0.0%	0	0.0%
	Resistant	34	18.8%	8	38.1%	4	36.4%
	Total	181	100.0%	21	100.0%	11	100.0%
Cefepime	Sensitive	148	81.8%	13	61.9%	7	63.6%
	Interme-diate	0	0.0%	0	0.0%	0	0.0%
	Resistant	33	18.2%	8	38.1%	4	36.4%
	Total	181	100.0%	21	100.0%	11	100.0%
Meropenem	Sensitive	181	100.0%	21	100.0%	11	100.0%
	Interme-diate	0	0.0%	0	0.0%	0	0.0%
	Resistant	0	0.0%	0	0.0%	0	0.0%
	Total	181	100.0%	21	100.0%	11	100.0%
Imipenem	Sensitive	178	98.3%	19	90.5%	10	90.9%
	Interme-diate	3	1.7%	2	9.5%	1	9.1%
	Resistant	0	0.0%	0	0.0%	0	0.0%
	Total	181	100.0%	21	100.0%	11	100.0%
Fosfomycin	Sensitive	159	87.8%	10	47.6%	7	63.6%
	Interme-diate	3	1.7%	1	4.8%	0	0.0%
	Resistant	19	10.5%	10	47.6%	4	36.4%
	Total	181	100.0%	21	100.0%	11	100.0%
Piperacillin/tazo-bactam	Sensitive	167	92.3%	14	66.7%	10	90.9%
	Interme-diate	10	5.5%	1	4.8%	0	0.0%
	Resistant	4	2.2%	6	28.6%	1	9.1%
	Total	181	100.0%	21	100.0%	11	100.0%
Nitrofurantoin	Sensitive	165	91.2%	9	42.9%	1	9.1%
	Interme-diate	6	3.3%	2	9.5%	0	0.0%

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	Resistant	10	5.5%	10	47.6%	10	90.9%
	Total	181	100.0%	21	100.0%	11	100.0%
Amikacin	Sensitive	177	97.8%	19	90.5%	10	90.9%
	Interme-diate	4	2.2%	2	9.5%	0	0.0%
	Resistant	0	0.0%	0	0.0%	1	9.1%
	Total	181	100.0%	21	100.0%	11	100.0%

Table 1. Antimicrobial susceptibility profile of the main bacterial species causing urinary tract infections in users of the SER Loja laboratory – Ecuador, year 2022 (continued)

		BACTERIAL SPECIES					
		Escherichia coli		*Klebsiella pneumoniae*		*Proteus mirabilis*	
		Count	Percentage %	Count	Percentage %	Count	Percentage %
Trimetho-prim/sulfametho-xazole	Sensitive	77	42.5%	8	38.1%	3	27.3%
	Interme-diate	2	1.1%	0	0.0%	0	0.0%
	Resistant	102	56.4%	13	61.9%	8	72.7%
	Total	181	100.0%	21	100.0%	11	100.0%
Cefoxitin	Sensitive	153	84.5%	13	61.9%	9	81.8%
	Interme-diate	1	0.6%	1	4.8%	0	0.0%
	Resistant	27	14.9%	7	33.3%	2	18.2%
	Total	181	100.0%	21	100.0%	11	100.0%
Gentamicin	Sensitive	157	86.7%	15	71.4%	7	63.6%
	Interme-diate	0	0.0%	0	0.0%	2	18.2%
	Resistant	24	13.3%	6	28.6%	2	18.2%
	Total	181	100.0%	21	100.0%	11	100.0%
Amoxicillin + clavulanic acid	Sensitive	130	71.8%	10	47.6%	11	100.0%
	Interme-diate	16	8.8%	2	9.5%	0	0.0%
	Resistant	35	19.3%	9	42.9%	0	0.0%
	Total	181	100.0%	21	100.0%	11	100.0%
Cefuroxime	Sensitive	129	71.3%	7	33.3%	7	63.6%
	Interme-diate	12	6.6%	3	14.3%	1	9.1%
	Resistant	40	22.1%	11	52.4%	3	27.3%

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	Total	181	100.0%	21	100.0%	11	100.0%
Ertapenem	Sensitive	181	100.0%	21	100.0%	11	100.0%
	Interme-diate	0	0.0%	0	0.0%	0	0.0%
	Resistant	0	0.0%	0	0.0%	0	0.0%
	Total	181	100.0%	21	100.0%	11	100.0%
Ciprofloxacin	Sensitive	99	54.7%	9	42.9%	5	45.5%
	Interme-diate	5	2.8%	0	0.0%	0	0.0%
	Resistant	77	42.5%	12	57.1%	6	54.5%
	Total	181	100.0%	21	100.0%	11	100.0%

Of the 229 study samples, 19.65% were found to be positive for ESBL while 80.35% were negative, see Figure 4.

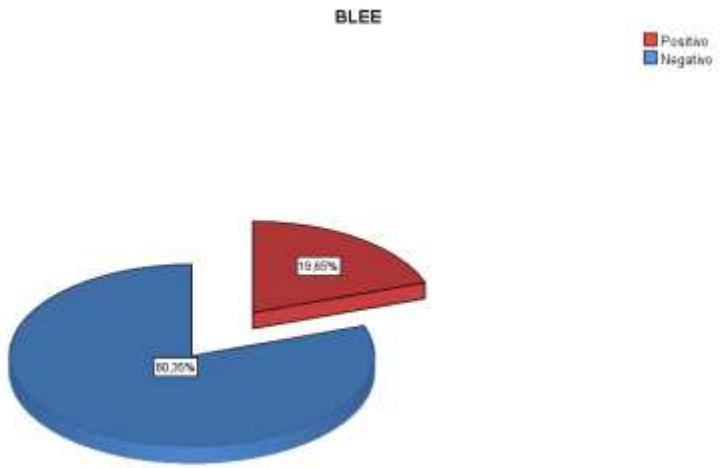

Figure 4. ESBL casesin users of the SER laboratory Loja – Ecuador, year 2022

Biological sex relationship – BLEE

Regarding the crossing of variables between biological sex and ESBL, it was found that 3.93% of males presented this type of ESBL resistance (positive), while 8.30% did not present any type of resistance. Regarding females, 15.72% presented this resistance while 72.05% did not present any type of resistance, see figure 5.

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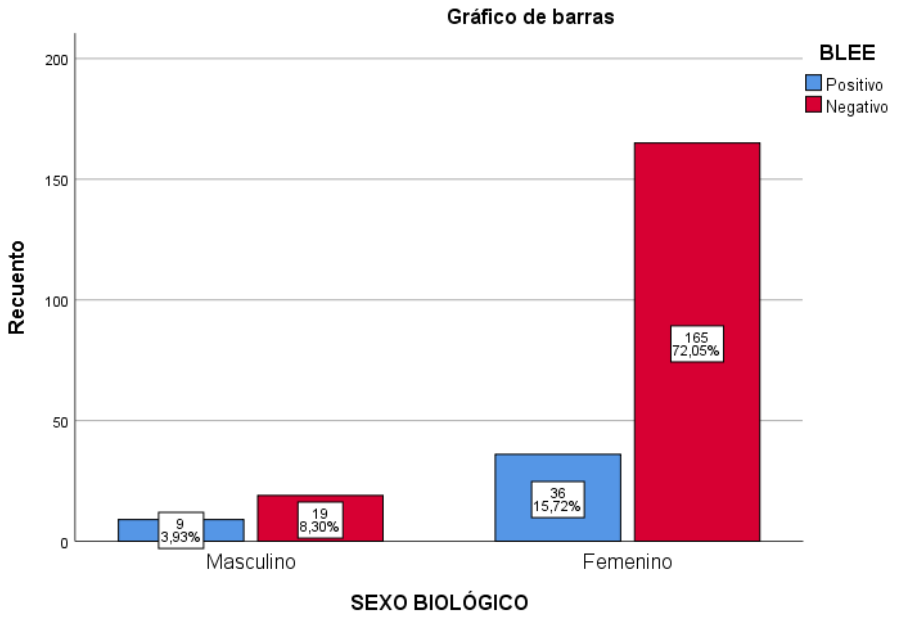

Figure 5.ESBL cases by biological sex in users of the SER laboratory Loja – Ecuador, year 2022

Age group relationship – BLEE

In relation to the age group and ESBL (see figure 6), of the 229 cases analyzed, the age group corresponding to old age (60 years or older) presents this type of resistance in 10.04%, followed by adulthood (25 - 59 years) with 5.68%, early childhood (0 - 5 years) with 2.18%, youth (19 - 24 years) with 1.31%, childhood (6 - 11 years) with 0.44% and adolescence (12 - 18 years) does not present this type of resistance, see figure 6.

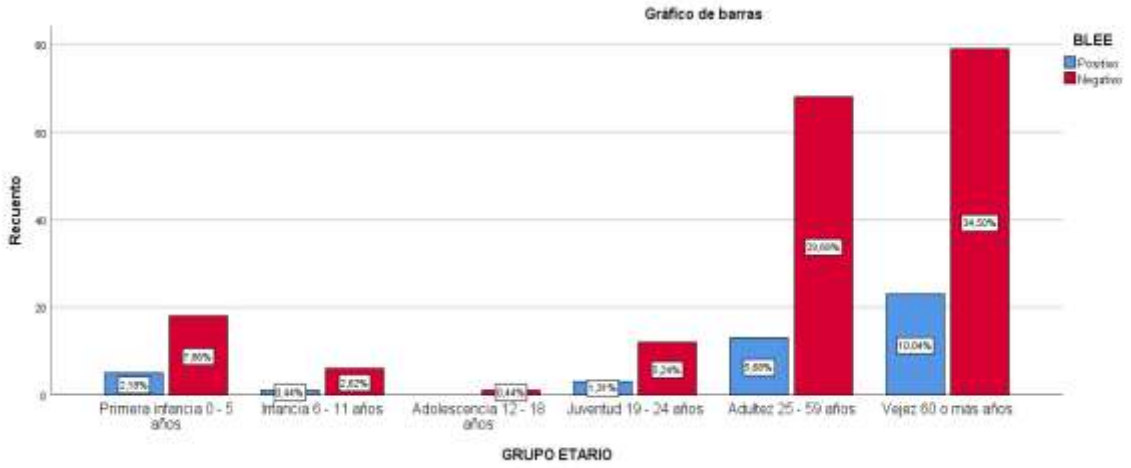

Figure 6. ESBL cases by age groupin users of the SER Loja laboratory – Ecuador, year 2022.

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Bacterial species - ESBL relationship

Regarding the relationship between bacterial species and ESBL (see table 2), it is established that Escherichia coli presents this type of resistance with 14.8% of the cases analyzed, followed by Klebsiella pneumoniae with 3.1%, Proteus mirabilis with 1.7%, see table 2.

Table 2. ESBL cases by bacterial speciesin users of the SER laboratory Loja – Ecuador, year 2022

Cross table BACTERIAL SPECIES*ESBL

			BLEE		
			Positive	Negative	Total
BACTERIAL SPECIES	Escherichia coli	Count	34	147	181
		% of total	14.8%	64.2%	79.0%
	Klebsiella pneumoniae	Count	7	14	21
		% of total	3.1%	6.1%	9.2%
	Edwardsiella spp.	Count	0	1	1
		% of total	0.0%	0.4%	0.4%

Table 2. ESBL cases by bacterial speciesin users of the SER laboratory Loja – Ecuador, year 2022 (continued)

			BLEE		
			Positive	Negative	Total
	Klebsiella aerogenes	Count	0	1	1
		% of total	0.0%	0.4%	0.4%
	Citrobacter cloacae	Count	0	3	3
		% of total	0.0%	1.3%	1.3%
	Morganella morganii	Count	0	2	2
		% of total	0.0%	0.9%	0.9%
	Proteus mirabilis	Count	4	7	11
		% of total	1.7%	3.1%	4.8%
	Proteus vulgaris	Count	0	5	5
		% of total	0.0%	2.2%	2.2%
	Pseudomona aeruginosa	Count	0	1	1
		% of total	0.0%	0.4%	0.4%
	Salmonella spp	Count	0	1	1
		% of total	0.0%	0.4%	0.4%
	Serratia marcescens	Count	0	2	2
		% of total	0.0%	0.9%	0.9%

Total	Count	45	184	229
	% of total	19.7%	80.3%	100.0%

Discussion

Urinary tract infection is one of the most common infections, affecting up to 150 million people worldwide each year, being the second most common infectious disease behind respiratory tract infections and the most common bacterial infection in women.(12,13).

UTIs occur more frequently in old age (44.54%) which differs from Guaraca et al (2022), in the city of Azogues - Ecuador; this may be due to risk factors such as diabetes mellitus, prostate diseases, uterine-vaginal prolapses, post-micturition residues, degenerative neurological diseases, vaginal dryness, age-related decrease in immune response, etc.(14,15).

The main pathogen causing UTI in the present study was Escherichia coli (79.04%), a figure that is consistent with another study carried out by Carriel et al. (2021), in Ecuador(16)and Naranjo et al.(2022), in Ecuador(17). It is also similar to other studies carried out in the world, as published by Navarrete et al. (2021), Peru(18)and Morales et al.(2023), in Mexico(12); indicating that worldwide the main bacterial agent causing UTI is Escherichia coli.

Regarding the results obtained from the bacterial agents causing UTI, Escherichia coli was found to be the main causal agent, followed by Klebsiella pneumoniae (9.17%) and Proteus mirabilis (4.80%); data that agree with a study carried out by Carriel et al. (2021), in Guayaquil, Ecuador.(16).

Regarding the antimicrobial susceptibility of Escherichia coli, it was found that trimethoprim/sulfamethoxazole is not a good therapeutic option for the management of infections caused by this, since it presented a resistance of 56.4%, data that agrees with a study carried out in Colombia by Orrego et al. (2014).(19)which obtained a resistance of E. coli to ampicillin and trimethoprim-sulfamethoxazole that presented the highest resistance rates (ampicillin 61%, trimethoprim-sulfamethoxazole 48%), followed by nalidixic acid (48%) and cephalothin (25%); however, it should be mentioned that in this study E. coli presented greater sensitivity to the antibiotics tested except for trimethoprim/sulfamethoxazole.

According to the susceptibility of Klebsiella pneumoniae in this study, it presented resistance to fosfomycin (47.6%), nitrofurantoin (47.6%), trimethoprim/sulfamethoxazole (61.9%), cefuroxime (52.4%), ciprofloxacin (57.1%); comparing with the results carried out in Paraguay by Leguizamón et al. (2017)(20)They found that K. pneumoniae showed a high resistance to quinolones, 53.8% to levofloxacin

and 60.7% to ciprofloxacin, the percentage of resistance to aminoglycosides was variable, low for amikacin (96.7% was sensitive), higher for tobramycin and gentamicin (55.9% and 53% resistance, respectively), resistance to trimethoprim-sulfamethoxazole was 58.1%, and to nitrofurantoin 51.9%; data that agree with the present study.

Regarding the antimicrobial susceptibility that Proteus mirabilis presented in this study, it presented resistance to nitrofurantoin (90.9%), trimethoprim/sulfamethoxazole (72.7%) and ciprofloxacin (54.5%); compared to a study carried out in Peru by Reátegui et al. (2019)(21)It showed sensitivity to cefepime, cefoperazone sulbactam, cefoxitin, gentamicin and imipenem with the highest efficacy of 75.0% each and with less effectiveness (resistance) to ampicillin sulbactam, cefadroxil, cefazolin, cefuroxime, nitrofurantoin, norfloxacin with 50.0% each; which is consistent with the results of the study.

According to the BLEE resistance mechanism, in a study carried out by Carriel and Ortiz (2021) in Ecuador, it presented 18.8%(16), similar to that of the present study (19.65%). In addition, as mentioned above, UTIs were higher in women and of these, those who did not present the ESBL resistance mechanism were 72.5%; similarly, in a study carried out by Remenik et al. (2020)(22), of which 85.48% of UTIs were female, however in this study the resistance mechanism was greater with 49.18% presenting it.

Chaupis et al. (2020)(23)It mentions that of the patients, 197 were under 60 years of age, of which 74 patients (50.4%) had ESBL UTI and 123 patients (51.1%) had non-ESBL UTI; which differs from the present study since the prevailing age is old age (60 years or older) in which 34.50% of patients presented non-ESBL UTI, which was the most representative of the study, so the age factor is not associated with ESBL UTI.

Authors such as Remenik et al. (2020)(22)They mention that the most frequently isolated microorganism was E. coli (85.41%), followed by Klebsiella pneumoniae (4.48%) and Staphylococcus saprophyticus (3.13%), where of the 714 patients who tested positive for ESBL UTI, 92.1% presented ESBL-producing E. coli, 5.7% presented ESBL-producing K. pneumoniae and 2.6% were positive for ESBL-producing Proteus mirabilis; however, in the present study, ESBL-producing E. coli was 14.85% and non-ESBL-producing E. coli was 64.19%, coinciding as the main ESBL-producing microorganism, although a considerable decrease in the production of this ESBL resistance mechanism is notable.

Conclusions

- The present investigation concludes that the main pathogen causing urinary tract infections in patients who attend the SER laboratory in the city of Loja is Escherichia coli, with a higher incidence in the female sex in the older age group (60

years or older), which generates resistance to antimicrobials by the mechanism of production of extended-spectrum beta-lactamases.

- In terms of resistance characteristics to the antibiotics tested, Escherichia coli, Klebsiella pneumoniae and Proteus mirabilis showed resistance to Trimetho-prim/sulfamethoxazole, thus demonstrating that it is not an empirical treatment option for UTI.
- For empirical treatment, the rate of microbial resistance should not exceed 20%, thus, according to the results, it is indicated that the antibiotic that can be used empirically for the treatment of UTI is amikacin, nitrofurantoin, fosfomycin; however, it would be very beneficial to perform urine cultures prior to the medical prescription of antibiotics.
- This type of research should be a priority, especially in the health field, since it allows for adequate prescription of antibiotics considering the different resistance profiles of Enterobacteriaceae that cause urinary tract infections.

Conflict of interest

There is no conflict of interest in relation to the submitted article.

Authors' contribution statement

The article must be accompanied by a note, which expresses the contribution of each author to the study carried out.

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