

Escherichia infections coli associated with healthcare at Camilo Cienfuegos General Hospital

Jaime Castillo ¹, Lázaro Rogelio Morell León ², Nidia Elena Díaz Rodríguez ³, Adrian González Méndez ^{4*}

¹Doctor of Medicine. First-Level Specialist in Microbiology. Master's Degree in Infectious Diseases. Provincial Center for Hygiene, Epidemiology, and Microbiology, Sancti Spiritus, Cuba.

²Doctor of Medicine. Second-Level Specialist in Hygiene and Epidemiology. Master's Degree in Higher Medical Education. Consulting Professor. Sancti Spiritus University of Medical Sciences, Cuba.

³Doctor of Veterinary Medicine. MSc. Preventive Veterinary Medicine. Assistant Professor. Department of Diagnostic Media. Sancti Spiritus University of Medical Sciences, Cuba.

⁴Bachelor's degree in Health Technology, Physical Therapy and Rehabilitation. Assistant Professor and Research Associate. Sancti Spiritus University of Medical Sciences, Cuba.

***Corresponding Author:** Adrian González Méndez, Bachelor's degree in Health Technology, Physical Therapy and Rehabilitation. Assistant Professor and Research Associate. Sancti Spiritus University of Medical Sciences, Cuba.

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Abstract

Introduction: Escherichia coli causes healthcare-associated infections with high morbidity, mortality, and multiple antimicrobial resistance. Objective: To microbiologically and epidemiologically characterize healthcare-associated infections to healthcare for Escherichia coli at the Camilo Cienfuegos Provincial Hospital in Sancti Spiritus between July 2022 and January 2023.

Methods: A descriptive and cross-sectional research with a mixed approach was carried out to identify the microbiological and epidemiological characteristics of healthcare-associated infections by Escherichia coli on the space horizon of the Camilo Cienfuegos Provincial Hospital in Sancti Spiritus, between July 2022 and January 2023.

Results: Theoretical and practical knowledge on the isolation of Escherichia coli in patients with Healthcare Associated Infections and identification of the microbiological and epidemiological characteristics in the institution, results indicating predominance of the age group 65 and over (44.4%), greater sensitivity in Meropen (100%) and lower for Cefotaxime (36.1%) and Cotrimoxazole (38.9%). Meanwhile, 73.9% corresponded to the ESBL production resistance mechanism in Escherichia coli.

Conclusions: Theoretical and practical knowledge on the isolation of Escherichia coli was identified. coli in healthcare-associated infections and the series of patients treated at the institution were characterized socio-demographically, microbiologically and epidemiologically, which indicated that there was a predominance of Escherichia isolates. coli in the age group 65 and over.

Kew Words: escherichia coli; associated infections; healthcare

Introduction

Escherichia coli (*E. coli*) is the main cause of Healthcare Associated Infections (HAIs) with high morbidity and mortality, largely due to the ability to develop multiple resistance to antimicrobials, which constitutes a current health challenge, since the increase in this resistance is a cause for great concern as it hinders the therapeutic approach to infected patients. [1] Nosocomial infections are infections acquired in hospitals. The term "healthcare-associated infections" is currently preferred because it encompasses not only hospital-acquired infections but also infections acquired in other settings where healthcare is provided. [1] The Infectious Diseases Society of America (IDSA) defines a group of bacteria included in the term *ESKAPE*: *Enterococcus faecium* vancomycin resistant (VRE),

Staphylococcus aureus methicillin-resistant (MRSA), *Klebsiella pneumoniae* Extended-spectrum beta-lactamase (ESBL) producer, *Acinetobacter baumannii*, *Pseudomonas aeruginosa* and *Enterobacter* species, including other enterobacteria such as *Escherichia coli*, as high-priority pathogens because they represent relevant clinical or public health problems, in addition to the fact that therapeutic alternatives in these cases are very limited. [2] Antimicrobial-resistant microorganisms, including multidrug-resistant types, commonly cause healthcare-associated infections (HAIs), but are also responsible for infections acquired outside of hospitals and can be detected in the normal bacterial flora of healthy people, pets, and the environment. Because antimicrobial-resistant microorganisms do not

respond to treatment, infections caused by these microorganisms carry a higher risk of death and prolong the duration of illness and hospitalization. [1,2] The World Health Organization (WHO) has published a global strategy and guidelines to help countries implement systems for monitoring antimicrobial resistance and adopt interventions. [3] Based on epidemiological surveillance of hospital infections in the last 5 years, in our country, the overall rate ranges between 2.6 and 2.9 per 100 discharges, with an annual average of 25,026 infected. [3]

At the Camilo Cienfuegos Provincial General Hospital, at the end of 2022, the Healthcare-Associated Infection rate was 1.7 per 100 discharges, higher than the previous year, which was 1.5, a cumulative incidence rate with an upward trend. In this institution, Enterobacteria, including *Escherichia coli* They have occupied the second place in isolations in clinical samples of patients with IAAS, with 13.1%, preceded by *Staphylococcus aureus* (28.1%) and *Acinetobacter sp* (7.6%) in third place, which emerges as a potential pathogen in critical patient care units. For the reasons mentioned above, this study aims to microbiologically and epidemiologically characterize Healthcare Associated Infections by *Escherichia coli* at the Camilo Cienfuegos Provincial Hospital in Sancti Spiritus, Cuba, between July 2022 and January 2023.

Methods

A descriptive and cross-sectional research with a mixed approach was carried out to identify the microbiological and epidemiological characteristics of the infections associated with to healthcare for *Escherichia coli* on the space horizon of the Camilo Cienfuegos Provincial Hospital in Sancti Spiritus, between July 2022 and January 2023.

The universe The study included 36 samples, *Escherichia coli* isolates in useful clinical samples (fundamental observation unit), duplicates were excluded and no sampling was performed given the feasibility of including all samples during the period analyzed. During the inclusion process, biases were controlled from its design and the basic requirements for the isolation of this type of microorganism were respected, including all people with identified HAIs, and complementing sources was carried out. The following procedures were performed to identify the presence of *Escherichia pathogenic coli* in the samples under study: -Sample collection: In all cases, compliance with the technical standards of the specialty was taken into account. The basic principles for the collection of microbiological samples were followed. -The culture sample was obtained from material from the

actual site of infection without contamination from adjacent tissues, organs, or secretions. An optimal period for sample collection was established, and sufficient samples were obtained to provide the best opportunity to isolate the causative microorganisms. Collection devices, sample containers, and appropriate culture media were used to ensure optimal isolation of microorganisms.

-The sample collection container is correctly labeled.

To identify the presence of different pathogenic microorganisms in the different samples, different media and reagents were used in the clinical microbiology laboratory, according to Cuban laboratory work standards, with biological products BIOCEN, OXOID, and the National Center for Scientific Research. The most commonly used and recommended oxidase reagent was a 1% aqueous solution of tetramethyl - p- phenylenediamine dihydrochloride. It is less toxic and much more sensitive than the corresponding dimethyl compound (Gordon- McLeod Regent), but is more expensive. This reagent stains oxidase-positive colonies lavender, gradually turning to deep purple-black.

Test performance:

-Indirect method on paper

- ✓ A piece of filter paper measuring approximately 3 x 3 cm was placed in a Petry dish.
- ✓ Kovacs reagent was added to the center of the paper.
- ✓ A cologne was spread onto the impregnated paper with a wooden applicator.
- ✓ The positive color reaction occurred after 10 seconds.

This research was approved by the Scientific Council and Ethics Committee of the Camilo Cienfuegos Provincial Hospital in Sancti Spiritus. The data collected were used solely for scientific purposes, and no patient personal information was disclosed.

Results

The distribution of the study samples where *E. coli* was isolated according to age is observed, where those over 65 years of age predominated (44.4%), followed by those between 45 and 64 years of age with 27.8% of the cases (Table 1).

Age	No.	%
0-28 days	2	5.6
18-24 years old	2	5.6
25-44 years old	6	16.7
45-64 years old	10	27.8
65 and over	16	44.4
Total	36	100

Source: Individual medical history and Research data registry.

Table 1. Patients under study by age. Camilo Cienfuegos Provincial Hospital, Sancti Spiritus. July 2022 to January 2023

The presence of the main risk factors described in the reviewed literature is represented. It reflects the predominance of invasive maneuvers performed, which constitutes 77.8%, followed by prolonged or frequent use of

antibiotics which represents 66.7%) and prolonged hospital stay in 63.9% of the sample (Table 2).

Risk factors	No.	%
Prolonged or frequent use of antibiotics	24	66.7
Invasive maneuver	28	77.8
Prolonged hospital stay	23	63.9
Prolonged stay in critical care ward	8	22.2

Immunosuppression	5	13.9
Chronic debilitating disease	11	30.6
Use of mechanical ventilation	6	16.7
Total parenteral nutrition	6	16.7

Source: Research data record.

Table 2: Risk factors present in the patients studied. Camilo Cienfuegos Provincial Hospital, Sancti Spiritus. July 2022 to January 2023. N=36

The distribution of patients according to the type of sample and the services of origin is shown. It is observed that the maternal and child service predominated (36.1%), which is conditioned by having more admission

rooms than the rest and the surgical, urine culture as a type of sample with the germs under study (Table 3).

Guy	Services							
	Clinical		Surgical		Attention to the serious		Maternal and child	
	No.	%	No.	%	No.	%	No.	%
Purulent sample	4	11.1	4	11.1	1	2.8	2	5.5
Blood culture	0	0	1	2.8	1	2.8	1	2.8
Bacteriological sputum	1	2.8	2	5.5	0	0	0	0
Catheter	0	0	3	8.3	1	2.8	2	5.5
Urine culture	2	5.5	3	8.3	0	0	8	22.2
Total	7	19.4	13	36.1	3	8.3	13	36.1

Source: Research data record.

Table 3. Clinical samples by hospital service of origin and sample type. Camilo Cienfuegos Provincial Hospital, Sancti Spiritus. July 2022 to January 2023. N=36

The distribution of isolated germs according to the location of the infection is represented. *Escherichia coli* is most frequently obtained in urine cultures (36.1% of the total of that species), followed by purulent samples with 11 cases for 30.6% (Table 4).

Sample type	<i>Escherichia coli</i>	
	No.	%
Purulent sample	11	30.6
Bacteriological sputum	3	8.3
Blood culture	3	8.3
Catheter	6	16.7
Urine culture	13	36.1
Total	36	100

Table 4. Isolated germs by sample type. Camilo Cienfuegos Provincial Hospital, Sancti Spiritus. July 2022 to January 2023.

Source: Research data record

The distribution of the samples according to the service of origin is summarized; there is a greater quantity of *Escherichia coli* for samples from the surgical and maternal and child services, both with 13 cases for 36.1% respectively (Table

Service of origin	<i>Escherichia coli</i>	
	No.	%
Clinicians	7	19.5
Surgical	13	36.1
Attention to the serious	3	8.3
Maternal and child	13	36.1
Total	36	100

Source: Research data record

Table 5. Germs isolated by service of origin. Camilo Cienfuegos Provincial Hospital, Sancti Spiritus. July 2022 to January 2023.

When analyzing the behavior of the bacteria in the antibiograms performed, a group of these showed almost complete resistance to third-generation cephalosporins, as well as to aztreonam (58.3%), with higher resistance values for cefotaxime and ceftazidime (Table 6).

Antibiotics	<i>Escherichia coli</i> (In vitro susceptibility)					
	Sensitive		Intermediate		Resistant	
	No.	%	No.	%	No.	%

Meropenem	36	100	0	0	0	0
Amikacin	24	66.7	2	5.6	10	27.8
Ciprofloxacin	30	83.3	0	0	6	16.7
Cotrimoxazole	14	38.9	3	8.3	19	52.8
Gentamicin	22	61.1	2	5.6	12	33.3
Ceftriaxone	16	44.4	0	0	20	55.6
Ceftazidime	13	36.1	0	0	23	63.9
Cefotaxime	13	36.1	0	0	23	63.9
Aztreonam	15	41.7	0	0	21	58.3

Source: Antibiogram performed and source of data recording

Table 6. Antimicrobial susceptibility of isolated germs according to the Kirby -Bauer method. Camilo Cienfuegos Provincial Hospital, Sancti Spiritus. July

2022 to January 2023. N=36

Discussion

It is known that patients infected by ESBL-producing strains generally have greater comorbidity, are more frequently hospitalized, mainly in Intensive Care Units, have received more antimicrobials and required greater health care than patients infected by non-ESBL-producing strains. [4] According to studies conducted by González et al ., [5] More cases of ESBL are detected in bacteria isolated from patients who have been administered antibiotics for long periods of time, with stay in Intensive Care Units, admitted to neonatal services, undergone surgery and mechanical ventilation, with prolonged hospitalization, affected by serious diseases, who have previously received cephalosporins or quinolones , with instrumentation or invasive catheterization, the same as Villegas et al . [6] and Ofner et al., [7], who conclude that they are more frequent in subjects with underlying diseases and risk factors, with some degree of immunosuppression, who are vulnerable to infection, and who, on the other hand, are for long periods of time in areas where ESBL-producing bacteria usually live. In relation to resistance to cefotaxime and ceftazidime by Miró et al., [8] as well as in a study of 38 laboratories, where they demonstrated that all institutions that used Ceftazidime reported an intermediate or resistant result in ESBL-producing microorganisms. Laboratories that included Ceftazidime (CAZ) in their tests were more likely to detect microorganisms producing these enzymes than those that did not use it. This should not be interpreted definitively as a selective advantage among the aforementioned antibiotics, but rather as a response to the resistance mechanisms specific to the strains in this study, which may change over time or in other hospital settings.

Conclusions

Theoretical and practical knowledge on the isolation of *Escherichia* was identified. *coli* in infections associated with healthcare and the series of patients treated at the institution who indicated that there was a socio-demographic, microbiological and epidemiological characterization predominance of *Escherichia isolates coli* In the age group 65 and over, greater sensitivity to Meropen and lower to Ceftazidime , Cefotaxime and Cotrimoxazole , high resistance due to production of ESBL in *Escherichia*

coli and the main risk factors identified were, in decreasing order, invasive maneuver, prolonged or frequent use of antibiotics, and prolonged hospital stay.

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