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ORIGINAL RESEARCH

Microbiological diagnoses in a pediatric gyneco-obstetric hospital. A single center report.

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Abstract

Introduction: The identification of pathogenic microorganisms is a key element in making clinical decisions and formulating strategies for the prevention and control of infectious processes that affect the pediatric population. The objective of the present study was to carry out a microbiological epidemiological profile in a pediatric hospital in Quito-Ecuador.

Methods: This is a retrospective observational study of microbiological reports of children treated at the Luz Elena Arismendi Pediatric Gyneco-Obstetric Hospital in Quito between January and December 2020.

Results: A total of 102 reports of positive cultures from the pediatric population were included in the study. Enterococcus faecalis 16/102 cases (15.69%), Staphylococcus aureus 16/102 cases (15.69%), Escherichia coli 14/102 cases (13.72%), Klebsiella pneumonia 13/102 cases (12.75%), and Staphylococcus epidermidis 13/102 cases (12.75%) explained the higher prevalence of the group. The months with the highest microbiological reports were June and November. There were 51 positive blood cultures, 14 for Enterococcus faecalis, 10 for Staphylococcus aureus, 10 cases, and 9 cases of various coagulase morphologies. At the level of cerebrospinal fluid, there were 11 positive reports with a prevalence of Staphylococcus epidermidis in almost 7 cases and Staphylococcus aureus in 4 cases. At the level of urine cultures, 12 cases were positive: Escherichia coli, 4 cases; Klebsiella oxytoca, 3 cases; and Klebsiella pneumoniae, 3 cases.

Conclusion: This report has similarities with Latin American reports in the prevalence of Staphylococcus and Escherichia coli. Continuity is required in the entire report. There were no multi-resistant cases.

Keywords: Blood Culture; Clinical Laboratory Techniques; Microbiological Techniques; Epidemiology, Urine Specimen Collection.

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Introduction

Even before Luis Pasteur experimentally demonstrated that bacteria were the cause of some diseases, many observers presented evidence for the theory of germs as pathological agents. For example, during the 16th century, Fra Castori of Verona suggested that diseases were due to invisible organisms that were transmitted from one person to another, and in 1792, Viennese Anton Van Plenciz, in addition to suggesting that the cause of disease was living agents, assumed that different germs caused different ailments [1].

Currently, microbiological diagnosis is fundamental in medical treatment, which is why various techniques have been developed and perfected to understand and identify the microbial ecology and the pathogenicity mechanisms of the most prevalent microorganisms [2].

Despite the advances in the identification of infectious microorganisms and the strategies implemented for the prevention and treatment of diseases associated with them, in developing countries and specifically in Latin America and the Caribbean, among the main causes of childhood morbidity and mortality are infectious diseases, to the extent that they are responsible for at least one in four deaths in children under 5 years of age [3].

In Ecuador, a survey of 2019 issued by the National Institute of Statistics and Censuses (INEC-2019) revealed that in the age group of 0-11 years, among the 10 main causes of morbidity, the first two places were pneumonia due to an unidentified organism and diarrhea/gastroenteritis of presumed infectious origin [4]. The INEC-2019 report does not define mortality rates; however, it is presumed that these rates are in line with Latin American trends, according to which these diseases, closely linked to exposure/consumption of unhealthy water, lack of sanitation and inadequate hygiene, produce approximately 900,000 deaths per year in child populations [5].

Infectious processes prevail in hospitalization services and pediatric intensive care units (PICUs), with a predominantly bacterial etiology (streptococci, staphylococci and pseudomonas, among others), followed by viral etiology (e.g., respiratory syncytial virus) and even fungal etiology (Candida), generating high health costs [6-10 Thus, it is relevant to establish epidemiological studies aimed at identifying the microbiological profile, preferably in each health center and regardless of its character public or private, to prevent acute infections in the conglomerates of children in its area of influence and control its incidence through concrete actions in the context of primary care. An investigation of pediatric infections in Ecuador carried out at the Ambato General Hospital reported Escherichia coli bacteria as the main etiology of urinary tract infections in 233 patients aged between 2 months and 14 years and 11 months [11], and the prevalence of community pneumonia was reported to be 15.29% in a sample of 3,244 hospitalized patients with an age range between 1 month and 14 years [12]. Due to the lack of standardized periodic reports, the objective of this study was to carry out an epidemiological profile based on the most frequent microbiological diagnoses in the Pediatric Service of the Luz Elena Arismendi Pediatric Gyneco-Obstetric Hospital in Quito-Ecuador in the period between January and December 2020.

Methods

Design of the investigation

It is a retrospective observational study.

Stage

The study was carried out at the Nueva Aurora Luz Elena Arismendi Pediatric Gyneco-Obstetric Hospital (HGONA), Quito, Ecuador. The study period was from January 1, 2020 to December 31, 2020. The report was completed on April 30, 2021.

Inclusion criteria

Cases of pediatric patients from 0 to 14 years old and 11 months admitted to the institution in the areas of the PICU and hospitalization, in whom a microbiological identification of a sample had been requested, were entered into the study. The elimination criteria were cases with incomplete or inconsistent records.

Study size

The sample calculation was nonprobabilistic, census type where all the microbiological reports in the study period were included.

Data / Measurement Sources

The data were collected from printed microbiological reports issued by the Clinical Laboratory of the hospital institution case study. The data were compiled in an electronic spreadsheet to later be transferred to the statistical software.

Statistical method

Descriptive statistics are used through tables, which represent the absolute and relative frequencies of the qualitative variables.

Results

The study included 102 pediatric cases with positive cultures. In the period studied, a variety of gram-positive and gram-negative bacteria were identified, with Staphylococcus aureus and Enterococcus faecalis (Table 1), which had a higher incidence in the months of March, June, December, respectively (Figure 1).

Most of the microbiological analyses were performed from blood cultures (Table 2),), issued mainly by the pediatric hospitalization service (Table 3).

Table 1 Microorganisms identified

Microorganisms	N=102	100%
Enterococcus faecalis	16	15.69
Staphylococcus aureus	16	15.69
Escherichia coli	14	13.72
Klebsiella pneumoniae	13	12.75
Staphylococcus epidermidis	13	12.75
Various morphologies CGP coagulase-	12	11.76
Klebsiella oxytoca	5	4.90
Enterobacter aerogenes	4	3.92
Candida albicans	3	2.94
Acinetobacter baumannii	2	1.96
Bacillus cereus	1	0.98
Proteus mirabilis	1	0.98
Pseudomonas aeruginosa	1	0.98
Staphylococcus hominis	1	0.98

Discussion

According to international reports, the prevalence of hospital infections by Staphylococcus aureus is 7% - 62.6% [13-14], Enterococcus faecalis: 0.1% -19.7%; Escherichia coli: 12.8% -55.5% and Klebsiella pneumoniae: 1.2% -12.8% [15-20]. This group mostly coincides with the prevalence reported in this study.

Table 2 Microorganisms according to sample source

Source	Microorganisms	n
Abscess	Staphylococcus aureus	1
Nasopharyngeal	Bacillus cereus	1
	Pseudomona aeruginosa	1
Catheter	Various morphologies CGP coagulase--	3
	Acinetobacter baumannii	2
	Enterobacter aerogenes	2
	Enterococcus faecalis	1
	Escherichia coli	1
	Klebsiella oxytoca	1
	Staphylococcus aureus	1
Feces	Klebsiella pneumoniae	3
	Klebsiella oxytoca	1
Cerebrospinal fluid.	Staphylococcus epidermidis	7
	Staphylococcus aureus	4
	Enterobacter aerogenes	2
	Escherichia coli	2
	Klebsiella pneumoniae	2
Orine	Escherichia coli	4
	Klebsiella oxytoca	3
	Klebsiella pneumoniae	3
	Enterococcus faecalis	1
	Proteus mirabilis	1
Blood	Enterococcus faecalis	14
	Staphylococcus aureus	10
	Various morphologies CGP coagulase-	9
	Escherichia coli	6
	Staphylococcus epidermidis	6
	Klebsiella pneumoniae	5
	Staphylococcus hominis	1
Tracheal discharge	Candida albicans	3
	Escherichia coli	1

Table 3. Microorganisms according to pediatric service

Service	Microorganisms	n
Hospitalization	Enterococcus faecalis	16
	Staphylococcus aureus	12
	Diversas morfologias CGP coagulasa-	10
	Escherichia coli	9
	Klebsiella pneumoniae	8
	Staphylococcus epidermidis	8
	Klebsiella oxytoca	6
	Enterobacter aerogenes	4
	Acinetobacter baumannii	2
	Bacillus cereus	1
	Klebsiella spp	1
	Proteus mirabilis	1
	Pseudomonas aeruginosa	1
PICU	Escherichia coli	5
	Klebsiella pneumoniae	5
	Staphylococcus epidermidis	5
	Candida albicans	3
	Various morphologies CGP coagulase-	2
	Enterococcus faecalis	2
	Staphylococcus hominis	1

PICU: pediatric intensive care unit

Comparatively, in a regional study with analysis of urine cultures [11],], a difference was found regarding the presence of Escherichia coli (42.49%), which in the present cohort obtained 13.72%, which is justified by the nature of the culture. This apparent discrepancy

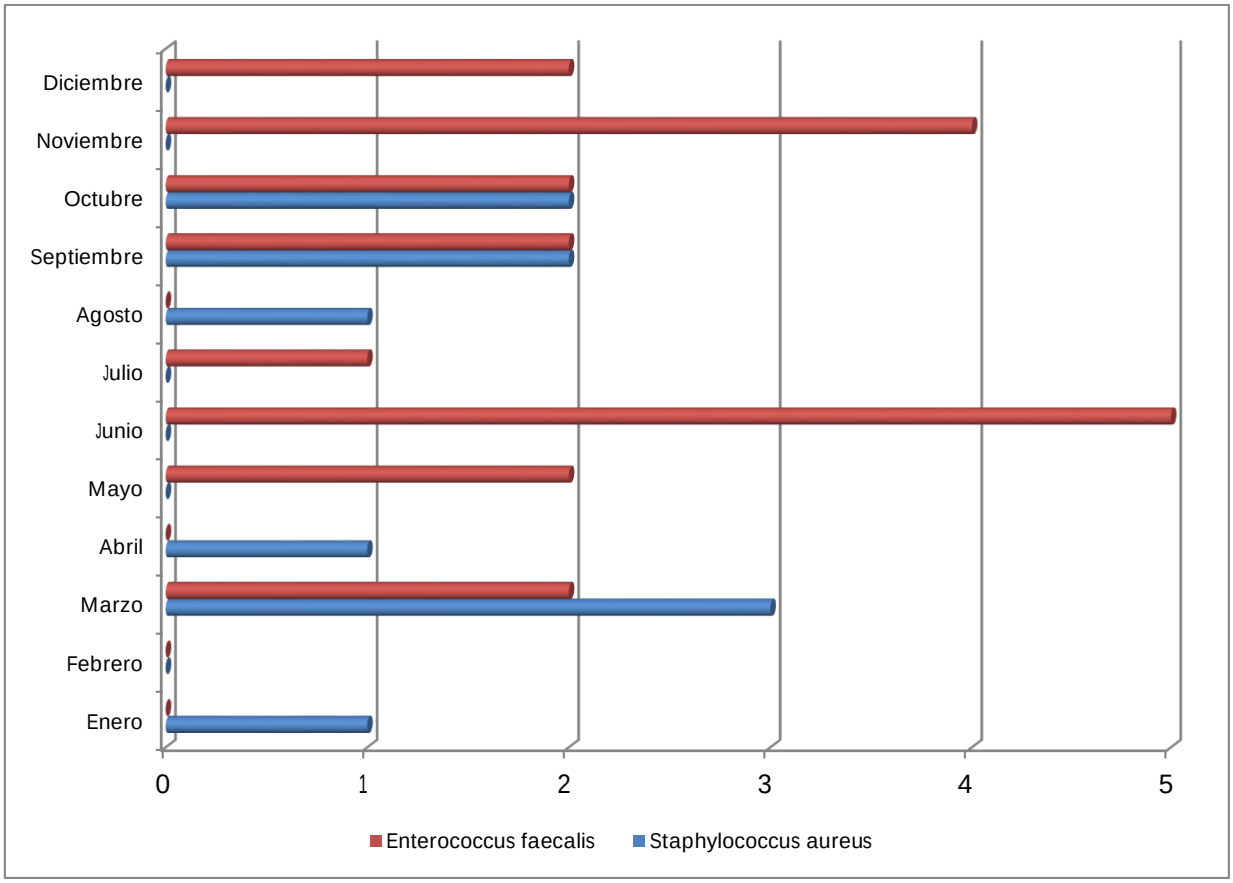

Fig. 1 Main pathogens according to month.

supports the need for prospective and retrospective research aimed at studying in detail the microbiological profile in the numerous hospital institutions dedicated to ensuring the health of the Ecuadorian child population.

Regarding the temporality in a national epidemiological study of two years of follow-up [4], the highest frequency of pediatric hospitalizations associated with infection was reported during January, February, March and May. In the present study, the most prevalent months were June and November.

According to the source of origin, the highest number of cultures in the microbiological laboratory was carried out from samples of blood (51), cerebrospinal fluid (17), urine (12) and catheter (11), which according to the literature they are common in the preparation of microbiological profiles of pediatric hospital areas and consequent orientation of antimicrobial therapy [15].

It is pertinent to highlight the isolation of Staphylococcus epidermidis in seven cultures of cerebrospinal fluid and six of blood, as well as Staphylococcus hominis in a blood culture, together with other coagulase negative CGP morphologies in blood samples (9) and taken from catheters (3), which represents a cumulative percentage of 24.49%, a figure lower than that reported from blood cultures where the most frequent contaminating germ was Staphylococcus epidermidis, from 47.5% [21] to 67.6% [22].

The clinical significance of cultivating "coagulase negative cocci" is not always easy to establish, since they can be harmless commensals or, on the contrary, invasive pathogens linked to bacteremia due to contamination of medical devices such as catheters,

valves, mechanical ventilators, or urinary infections. and cutaneous, among others [23]. Therefore, the identification of these staphylococci according to species should be a routine practice in every clinical microbiology laboratory, with the aim of establishing preventive measures in pediatric hospitalization areas, the eradication of infectious processes and even their resistance to antimicrobials.

On the other hand, it is worth noting that in the microbiological reports considered for this report there was only one culture of Bacillus cereus, identified in nasal aspirate, a finding not reported in the consulted literature; The spores of this gram + bacillus are reported to be abundant in the soil, fresh water, hospital environment and even in the gastrointestinal flora, and can cause acute gastroenteritis and fatal systemic infections in newborns, but it is considered a contaminant when isolated from clinical samples and its the most common characteristic in true bacteremia, given its presence in an intravascular catheter [24].

In contrast, microbiological studies in the pediatric setting report isolation of Campylobacter sp. and Shigella flexneri [18, 25], not observed in the present study, which is paradoxical since these enteropathogens are, together with Escherichia coli, the most associated with gastrointestinal tract infections [26-28], although the latter bacterium was isolated in the microbiological laboratory from HGONA in blood, tracheal secretion, urine, cerebrospinal fluid and catheters but not in stool cultures. These findings are useful for the approach and control of respiratory and urinary tract infections, bacterial meningitis and bacteremia related to venous catheters in the pediatric units of the institution.

Regarding the isolation and identification of microorganisms according to clinical area, the highest number of cultures were ordered by the hospitalization service (77.45%), with a relative predominance of gram bacilli and cocci, results that are close to those reported in some of the Epidemiological studies reviewed [11, 15, 17-19], although others report a clear prevalence of gram + bacteria [20, 29]. For this reason, it is presumed that this variability would be influenced by geographic-climatic and socioenvironmental conditions and perhaps typical of each health institution, a reflection that again insists on the importance of identifying epidemiological profiles to determine the behavior of microorganisms of clinical importance to guide the corresponding containment measures.

In the case of the PICU case study, a significant numerical difference was identified in favor of gram + bacteria, coinciding with what was reported in single-center [16, 21] and multicenter [30]; investigations. In these studies, the multiresistance of pathogenic bacteria was also evaluated, which makes it advisable to continue with this study, identifying the bacterial resistance of each species.

Additionally, in accordance with the reports issued by the microbiological laboratory under study, only the PICU sent samples of tracheal secretions (3 = 2.94%) that were positive for Candida albicans on culture, a frequency that exactly coincides with that reported in a study carried out in Mexico [31], but it collides with those identified in an investigation in India [16], where this fungal infection occurred in 39% and it is pointed out that the increasing rates of its isolation could be a reflection of the greater use of antibiotics in the PICUs . However, in parallel, it is argued that its role as a pathogen is not entirely clear and that in any case, it is an opportunistic fungal infection [32]. Faced with such discrepancies, the importance of new research aimed at verifying the role of C. albicans as an infectious microorganism in critically ill pediatric patients is important, which is why microbiological identification must continue in 2020 and 2021 in cultures processed in the clinical laboratory of the Luz Elena Arismendi Pediatric Gyneco-Obstetric Hospital.

Conclusions

The bacteria Enterococcus faecalis, Staphylococcus aureus, Escherichia coli, and Klebsiella pneumoniae are the most prevalent bacteria grown in children. The most prevalent months for infectious reports are June and November.

Abbreviations

HGONA: Pediatric Gyneco-Obstetric Hospital of Nueva Aurora Luz Elena Arismendi. PICU: Pediatric Intensive Care Unit..

Supplementary information

Supplementary materials are not declared.

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Authors' contributions

Moisés Humberto Cáceres Pérez: Conceptualization, Data Conservation, Fund Acquisition, Research, Resources, Software, Writing - original draft, Writing: review and editing.
Carolina X. Meneses C ,: Conceptualization, Data preservation, Acquisition of funds, Research, Resources.
Deivis E. Ortega C: Data curation, investigation, acquisition of funds.
Gabriela C. Tasinchano T: Methodology, Formal analysis, Project management, Supervision, Validation, Visualization.
Alex D. Guano T: Conceptualization, Data Conservation, Fund Acquisition, Research, Resources

Financing

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Availability of data and materials

The data sets generated and/or analyzed during the current study are not publicly available due to the confidentiality of the participants but are available through the corresponding author upon reasonable academic request.

Declarations

Ethics committee approval and consent to participate

This work has the approval of the Research Ethics Committee of the Pediatric Gyneco-Obstetric Hospital of Nueva Aurora Luz Elena Arismendi, with the approval number Dfr-2031-23.

Publication consent

It does not apply to studies that do not publish MRI/CT/Rx images or physical examination photographs.

Conflicts of interest

The authors declare no conflicts of interest.

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