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Original Article

J Clin Gynecol Obstet. 2019;8(4):103-106

Current Status of Bacterial Resistance in Obstetric Patients in a Third Level Center

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Abstract

Background: The aim of the study was to know the range of bacterial resistance in pathogens of epidemiological importance isolated from urine samples, secretion of surgical wound and blood culture in the Instituto Nacional de Perinatologia.

Methods: In this retrospective study, we reviewed all the antibiograms obtained from isolates of microorganisms from: urine, surgical wound secretion and blood culture of obstetric patients (pregnancy and puerperium) in the period from January 2016 to June 2019 at the Instituto Nacional de Perinatologia.

Results: A total of 3,322 microorganisms were isolated, 2,882 from urine sample, 270 from surgical wound secretion and 170 from blood cultures. The most frequent microorganism isolated was *Escherichia coli* (2,223 isolates), 2,042 from urine samples, 98 from surgical wound secretion and 83 from blood cultures.

Conclusions: The use of the results of antimicrobial susceptibility of the isolated microorganisms allowed producing record from 2 years of pharmacological resistance for most of the species of epidemiological importance. Same results will allow initiating an empirical management under a sustenance of scientific evidence.

Keywords: Antibiotic resistance; Infection; Antibiogram; Obstetrics

Manuscript submitted September 21, 2019, accepted October 11, 2019

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doi: https://doi.org/10.14740/jcgo599

Introduction

Antibiotic-resistant infections are a growing health problem [1]. The Center for Disease Control (CDC) estimates that 23,000 patients die each year due to bacterial resistance [2]. Although the introduction of antibiotics allowed a marked increase in hope of life, it also increased alarmingly the bacterial resistance that threatens to impede this advance and poses significant risks to the safety of public health worldwide [2]. Bacterial resistance is a reflection of the excessive use of antibiotics, and this use accelerates the development of resistant bacteria and reduces the effectiveness of existing antibiotics [3]. Recent studies have found that the intrahospital use of broad-spectrum antibiotics increased in the period 2006 - 2012 and that 30% of antibiotics prescribed on an outpatient basis in 2010 - 2011 were probably inappropriate or unnecessary [4]. The objective of the present study was to know the range of bacterial resistance in pathogens of epidemiological importance isolated from urine samples, secretion of surgical wound and blood cultures in the Instituto Nacional de Perinatologia.

Methodology

In this retrospective study, we reviewed the total antibiograms obtained from isolates of microorganisms from: urine, secretion of surgical wound and blood culture of obstetric patients (pregnancy and puerperium) in the period from January 2016 to June 2019 at the Instituto Nacional de Perinatologia. The bacteria resistance rates for the antibiotics in the samples were calculated.

Results

A total of 3,322 microorganisms were isolated, 2,882 from urine sample, 270 from surgical wound secretion and 170 from blood cultures. The most frequent microorganism in all isolates was *Escherichia coli* (2,223 isolates), 2,042 from urine samples, 98 from surgical wound secretion and 83 from blood cultures (Table 1). The second most frequently isolated microorganism was *Streptococcus agalactiae* (263 isolates) in urine samples: *Enterococcus faecalis* (48 isolates) in surgical wound secretion and *Klebsiella pneumoniae* (22 isolates) in blood cultures. *E. coli* producing extended-spectrum beta-lactamases

Table 1. Isolations From Urine Samples, Surgical Wound Secretion and Blood Samples

Microorganisms	Number of isolations		
	Urine (n = 2,882)	Surgical wound secretion (n = 270)	Blood (n = 170)
Escherichia coli	2,042	98	83
Streptococcus agalactiae	263	-	-
Enterococcus faecalis	167	48	
Klebsiella pneumoniae	147	19	22
Staphylococcus epidermidis	-	40	11
Staphylococcus aureus	-	-	9
Others	263	65	45

(ESBLs) was found in 30% of urine samples, 52% of surgical wound secretion and 51% of blood cultures.

Regarding the bacterial resistance, the main bacteria found were analyzed. In the analysis for aminoglycosides against *E. coli*, the resistance was 0% for amikacin, 23% for gentamicin and 36% for tobramycin. When analyzing beta-lactams, the resistances were 11-85%, for carbapenems, 0-1% for furans and was 0%, specifically, for nitrofurantoin (Table 2).

In secretion of surgical wound, for *E. coli*, the bacterial resistance against aminoglycosides such as amikacin and gentamicin was 0% and 30%, respectively, and 53% for ciprofloxacin and 0% for carbapenems (Table 3).

In blood culture samples (Table 4), the resistance of *E. coli* against aminoglycosides such as amikacin was 1%, gentamicin 22% and tobramycin 17%; against beta-lactams 25-67%, cephalosporins such as ceftriaxone 30%, cefuroxime 50%, ceftazidime 60% and cefoxitin 10%.

Discussion

In 2018, the Universidad Nacional Autonoma de Mexico made a report including 14 institutions, which is a sample of the current reality in the area of microbiology in the country. In total, 3,182 blood cultures and 8,718 urocultures were included, the *E. coli* being the main microorganism isolated in a general way in all the centers (67%), which is similar to our result, followed in frequency by *Klebsiella pneumoniae* (11%). For *E. coli*, the bacterial resistance found for beta-lactams such as ampicillin, was 87%, for aminoglycosides, such as amikacin, was 3%, for cephalosporins was greater than 60% and for carbapenems was 2-7% [5], which are very similar to those presented in our study.

Garza Gonzalez and collaborators published a retrospective study in March 2019, which included 47 centers from 20 states in the country of Mexico. In this study, they selected the potential causes of infectious disease in a period of 6 months. A total of 22,943 strains were included; the most frequently isolated germ from all samples, was, as in our study, *E. coli* (11,676 isolates), followed by *Klebsiella pneumoniae* (3,334 isolates) and in third place, *Enterobacter sp.* (1,334 isolates). Regarding the resistance against carbapenems, this was 3% for *E. coli*, 12.5% for Klebsiella and Enterobacter and greater than 40% for *Pseudomonas aeruginosa*. The rate of resistance against piperacillin-tazobactam was 19.1% for *Pseudomonas aeruginosa*. Methicillin resistance in *Staphylococcus aureus*

Table 2. Bacterial Resistance in Urine Samples

	Escherichia coli		*Staphylococcus epidermidis*		*Enterococcus faecalis*	
Amikacin	0%	77	NA	NA	NA	NA
Gentamicin	23%	87	28%	40	NA	NA
Tobramycin	36%	22	NA	NA	NA	NA
Amoxicillin - clavulanic acid	11%	65	NA	NA	NA	NA
Ampicillin	85%	87	NA	NA	NA	NA
Ampicillin - sulbactam	53%	38	NA	NA	NA	NA
Ceftriaxone	58%	98	NA	NA	NA	NA
Ertapenem	0%	87	NA	NA	NA	NA
Meropenem	1%	98	NA	NA	NA	NA
Nitrofurantoin	0%	85	0%	40	0%	47
Ciprofloxacin	49%	87	25%	40	4%	47
Levofloxacin	29%	17	13%	40	4%	47

NA: not analyzed.

Table 3. Bacterial Resistance in Samples of Surgical Wound Secretion

	Escherichia coli		*Klebsiella pneumoniae*		*Staphylococcus epidermidis*	
Amikacin	0%	60	0%	13	NA	NA
Gentamicin	30%	66	59%	17	36%	11
Tobramycin	46%	24	70%	10	NA	NA
Amoxicillin - clavulanic acid	24%	42	43%	7	NA	NA
Ampicillin	82%	62	100%	17	NA	NA
Ceftriaxon	53%	83	55%	22	NA	NA
Ertapenem	0%	42	0%	17	NA	NA
Meropenem	0%	83	0%	22	NA	NA
Vancomicin	NA	NA	NA	NA	0%	11
Ciprofloxacin	53%	66	NA	NA	0%	17
Levofloxacin	55%	20	NA	NA	0%	6

NA: not analyzed.

was as high as 21.4% [6].

In the results of the present study, amikacin showed a low rate of resistance against *E. coli* (less than 1%), which suggests that it remains a valuable option for the treatment of urinary tract infections, as publicized in the previously mentioned studies [5, 6]. However, it should be considered that aminoglycosides are one of the causes of drug-induced nephrotoxicity and ototoxicity [7]; therefore, close monitoring of the patient is required, and other therapeutic alternatives such as fosfomycin and nitrofurantoin should be considered.

The potential production of ESBLs detected is alarming, 30-52% depending on the sample from which the isolation was obtained. The distribution of the bacteria producing these enzymes is only 20 years old in Mexico and their migration has been rapid, limiting the alternative therapies for all the types of infections studied in our study [8, 9].

Our study presents several limitations, such as showing results from a single center and only studying isolates from urine, surgical wound secretion and blood cultures, as well as being a retrospective study with a very select population group, that is, obstetric patients, be pregnant or taking the puerperium. However, it shows similar results to the aforementioned studies on bacterial resistance in Mexico with information from a little more than 2 years of study in obstetric population.

In conclusion, the use of the results of antimicrobial susceptibility of microorganisms isolated from urine samples, surgical wound secretion and blood cultures at the Instituto Nacional de Perinatologia, allowed producing record from 2 years of pharmacological resistance for most of the species of epidemiological importance. Same results will allow initiating an empirical management under a sustenance of scientific evidence.

Acknowledgments

The authors would like to give thanks to all the personal at

Table 4. Bacterial Resistance in Samples From Blood Cultures

	Escherichia coli		*Streptococcus agalactiae*		*Enterococcus faecalis*	
Amikacin	1%	2,009	NA	NA	NA	NA
Gentamicin	22%	2,035	NA	NA	NA	NA
Tobramycin	17%	2,000	NA	NA	NA	NA
Amoxicillin - clavulanic acid	25%	36	NA	NA	NA	NA
Ampicillin	67%	2,035	0%	255	2%	166
Ampicillin - sulbactam	34%	2,005	NA	NA	NA	NA
Ceftriaxon	30%	2,042	NA	NA	NA	NA
Ertapenem	0%	2,033	NA	NA	NA	NA
Meropenem	0%	2,036	NA	NA	NA	NA
Nitrofurantoin	1%	2,036	1%	242	NA	NA
Ciprofloxacin	46%	2,036	7%	256	13%	164
Levofloxacin	60%	5	6%	257	13%	164

NA: not analyzed.

Instituto Nacional de Perinatologia.

Financial Disclosure

None to declare.

Conflict of Interest

The authors declare no conflict of interest.

Informed Consent

Patient's informed consent for publication of this report was obtained.

Author Contributions

All the authors actively participated in the present work.

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