

3rd generation cephalosporin resistance toward microorganisms found in urine and vaginal discharges in Iraqi women in the mid Euphrates region

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SUMMARY

AUTHORS' CONTRIBUTION: (A) Study Design · (B) Data Collection · (C) Statistical Analysis · (D) Data Interpretation · (E) Manuscript Preparation · (F) Literature Search · (G) No Fund Collection

This study intends to examine antimicrobial resistance patterns especially in vaginal swab samples and urine from patients at Al-Sader Hospital as hospitalized patients by standard microbiological technique from April to June of 2023, in order to address the major worldwide threat posed by antimicrobial resistance to the treatment of bacterial infections, particularly in low- and middle-income regions like Iraq. A total number of 200, samples were collected for the detection of pathogenic bacteria; all clinical samples were collected from patient urine, urethral or cervical discharge, pus/swab from wound, ear discharge, nasal and throat swab. From all bacterial isolates 82.89% were found resist to cefixime while (3.28%) recorded intermediate and (13.81%) recorded susceptible, but (70.39%) recorded resistant against ceftriaxone of the all-bacterial isolates and both intermediate and susceptible were (7.89%). The resistance of bacteria is on the rise, because the results showed that most of the isolated bacterial strains are resistant to the third generation of cephalosporins. Accordingly, the recommendations were that it is important to choose the appropriate drugs based on the results of the antibiotic resistance susceptibility test.

Keywords: Vaginal discharge; Bacteria; Cephalosporins

INTRODUCTION

Antimicrobial Resistance (AMR) is one of the developing problems in the recent century and is the most severe hazards to worldwide public health [1]. It places a significant problem on everyone, in terms of patient morbidity and economic cost. Increasing AMR pathogens can cause a great percent of hospital acquired infections and medical difficulties around the globe, yet the matter established slight concern by health care segments [2], the number of resistant microbial strains in each organism affected by resistance of the drugs that can escalate the extent of resistance [3]. In low income countries, illogical uses of antimicrobials, drugs availability over the counter and absence of the antimicrobial sensitivity tests in the clinical microbiological laboratories result in high incidence of infections that made the AMR is challenge [4].

In low income countries, illogical uses of antimicrobials, drugs availability over the counter and absence of the antimicrobial sensitivity tests in the clinical microbiological laboratories result in high incidence of infections that made the AMR is challenge [5]. This can adversely affect treatment outcomes, disease spread, and duration of illnesses and costs that affected in serious manner on the future of chemotherapies [6]. The drug companies, clinicians, researchers and public who are seeking of effective drugs are facing difficulties due to bacterial susceptibility to drugs [7], The bacterial resistance crisis has been significantly attributed to the abuse and overuse of antibiotics, The epidemiology of a resistance offers valuable information for preclusion and supports clinicians to prescribe the operative antibiotic therapy, in addition to adjust the use of antibiotics is important in control of drug resistance [8]. For this reason, study was performed to compare between cephalosporins as most appropriate treatment for infections in Najaf city.

METHODS

Specimen collection and bacterial identification: A number of 200 samples were collected during the stated time. For the discovery of bacteria that are pathogen, all clinical samples were collected from patient admitted

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Word count: 1514 **Tables:** 01 **Figures:** 01 **References:** 23

Received: 03.06.2024, Manuscript No. gpmp-24-143170; **Editor assigned:** 04.06.2024, PreQC No. P-143170; **Reviewed:** 17.06.2024, QC No. Q-143170; **Revised:** 21.06.2024, Manuscript No. R-143170; **Published:** 28.06.2024

to Al-Sader Hospital as hospitalized patients by typical microbiological technique [9]. The swab/ pus from urine, ear /discharge, wound, nasal or throat swab, urethral or cervical discharge and seminal fluid were used as specimens. According to the samples, sources, each sample were plated onto Mannitol Salt agar, MacConkey agar, Blood agar, Thayer martin agar (Oxoid, UK), after that aerobically incubated for twenty-four hours at thirty seven centigrade. The Species of bacteria were recognized as per the standard microbiological methods [9].

Antimicrobial susceptibility testing: The test of susceptibility was performed on isolates using the agar disc-diffusion technique according to Kirby–Bauer method on Mueller–Hinton agar (Oxoid, England) [10]. Accordingly, at least 3 to 5 colonies which well-isolated from the similar morphological kind were carefully chosen from an agar plate culture then transferred and incubated into Muller Hinton broth twenty-four hours at thirty-seven centigrade. The suspension's turbidity was typically comparable to that of the 0.5 McFarland standards by adjusting with sterile saline. After that, the swab was marked over the whole surface of freshly prepared Mueller Hinton agar plate. The disks that contained the antimicrobial were applied within fifteen minutes to the plates after inoculation and then incubated for twenty-four hours at thirty-seven centigrade. The inhibited region was measured and the sensitive, resistant, or intermediate state were read as results based on

Clinical and Laboratory Standards Institute [11] the antibiotics tested were third-generation cephalosporin: ceftriaxone (30 µg) and cefixime (30 µg).

Data Analysis Descriptive analysis of this study was used frequencies and mean. Data were analysed by Statistical Package for Social Science (SPSS) version 16. The statistically significant differences were considered at P value <0.05 and the results were presented using tables.

RESULTS

A total of 200 clinical specimens were obtained from included urine, sputum, semen, high vaginal swab (Hvs), throat swab and wound swab, from in patient in Al-Sader hospital in AL-Najaf city in Iraq. Among the different clinical samples were tested, a total of 152 (72.38%) were positive bacterial growth. 21.71% Urine, 4.61% Ear

swab, 20.39% Hvs, 3.29% Wound, 0.66%, sputum, and 0.66% Throat. Among the bacterial growth, 31.58% *E. coli*, 15.79% *Klebsiella* spp, 1.32% *Proteus* spp, 6.58% *Pseudomonas aeruginosa*, 1.97% *Neisseria gonorrhoea*, 20.39% *Staph aureus*, 10.53% *Staph saprophytic*, and 11.84% *Streptococcus* spp, **Fig. 1**. The resistant of bacterial isolates to cefixime was 126 (82.89%), 5 (3.28%) was intermediate and 21(13.81%) was susceptible while 107 (70.39%) was highly resistant against ceftriaxone of the all-bacterial isolates and 12(7.89%) as intermediate and 12(7.89%) was susceptible.

The bacteria that exhibited the most resistance to antibiotics was *E. coli*, which showed high resistance to 33 cefixime (73.33%) and 27 ceftriaxone (60.66%), whereas *Staph aureus* showed strong resistance to 30 cefixime (100%) and 29 ceftriaxone (96.66%) (**Tab. 1**).

DISCUSSION

In the twenty-first century, the problem of antibiotic resistance is a steadily increasing problem and represents the greatest threat to public health on a global basis. Hence, disease agents once believed to exist to be vulnerable to antibiotics come back in new leagues Resistance to these treatments [12].

This study showed that the isolates taken from female were resistant for third-generation cephalosporin was not significant in isolates taken from female, where the resistance to third-generation antibiotics was similar to the patron for both types of treatment under study. This result is identical to the results of previous research [13].

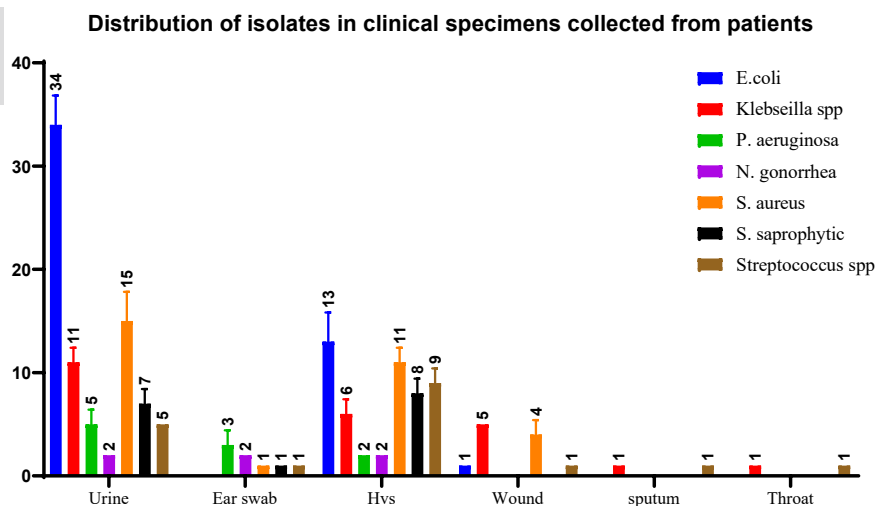
The antibiotic resistance pattern differs for the same type of bacterial isolates based on the type of the sample. According to this study, no significant difference was observed for all bacterial isolates in their resistance to both types of antibiotics under study (ceftriaxone, cefixime). The majority of these *E. coli* isolates were isolated from urinary tract infections and were mostly elevated for both types of antigens (**Fig. 1**). This type of bacteria has a wide history of antibiotic resistance, causing difficulty in treating vaginal and urinary tract infections [12], which makes it a strong candidate for further development of its resistance to treatment.

In addition, the *E. coli* isolated from the rest of the samples showed clear resistance to the third-generation cephalosporin. This is what was mentioned in many

Tab. 1. Pattern of Resistance in the different clinical isolates to antibiotics.

Clinical Isolates	Ceftriaxone			Cefixime		
	Resistant	Intermediate	Susceptible	Resistant	Intermediate	Susceptible
<i>E. coli</i>	27(60%)	-	18(40%)	33(73.33%)	5(11.11%)	7(15.55%)
<i>Klebsiella</i>	15(62.5%)	8(33.33%)	1(4.1%)	19(79.16%)	-	5(20.83%)
<i>Proteus</i>	2(100%)	-	-	1(50%)	-	1(50%)
<i>pseudomonas</i>	5(50%)	-	5(50%)	6(60%)	-	4(40%)
<i>N. gonorrhoeae</i>	2(1(66.66%)		1(33.33%)	3(100%)	-	-
<i>Staph aureus</i>	29(96.66%)	-	1(3.33%)	30(100%)	-	0
<i>Staph saprophyt</i>	20(100%)			20(100%)	-	-
<i>Streptococcus</i> spp	9(50%)	2(11.11)	7(38.88)	14(77.77%)	-	4(22.22%)
Total	107(70.39%)	12(7.89%)	33(7.89%)	126(82.89%)	5(3.28%)	21(13.81%)

Fig. 1. Distribution of isolates in clinical specimens collected from patients.



previous researches [14,15], in the research that was carried out in some researches it was shown that the resistance of *E. coli* to ceftriaxone was at higher rates than its resistance to cefixime [16,17].

Most of the staphylococci in this study were resistant to both third-generation antibiotics without a significant difference for both types of antibiotics, and this result does not match a number of other studies that showed that staphylococcal strains are resistant to ceftriaxone at higher rates than their resistance to cefixime. And the search showed [18]. The research under study showed that *Staphylococcus aureus*, in the majority of its number, was isolated from urinary tract infections and vaginal infections. Causing urinary and vaginal infections [19], and this indicates with certainty that this type of isolate continues to develop resistance to antibiotics, especially antibiotics of the third generation of cephalosporins [20].

The results of this study are *S. aureus* isolates that have the same ability to resist the antibiotics under study compared to *S. aureus*, and this is not similar to the results of previous research, which showed that *S. aureus* has an ability to resist treatment that exceeds the ability of other Staphylococcus types [21].

Most of *Klebsiella* isolates in this research are resistant to both types of third-generation antibiotics, but they show higher resistance to cefixime compared to ceftriaxone, and this result was not identical to other previous research that claimed that they are resistant to third-generation antibiotics in the same way [22].

As for isolates of *Pseudomonas aeruginosa*, *Proteus* bacteria, and *Streptococcus aureus*, they are resistant to ceftriaxone at a higher rate than cefixime. This result agreed with other research results [16,23].

CONCLUSION

Significant increase in bacterial resistance to the third

generation cephalosporins and these same third-generation resistant strains are based on many other types of antibiotics, which makes it difficult to determine effective treatment. This study recommends interest in collecting data of antibiotic-resistant bacterial isolates and using them in choosing the right treatment.

FUNDING

This study did not receive any funding.

ETHICAL CLEARANCE

The protocol of a study has been accepted as stated by the Ethical Committee in the Najaf Health Directorate on 2-10-2019. In addition, before taking the sample; verbal agreement was gotten from the patients. Health safety was engaged during sampling. This study was done according to the Iraqi Ministry of Health Ethics Committee also it was agreed with all national regulations.

AUTHORS' CONTRIBUTIONS

Designed the study and drafted the manuscript: HDSS. Collected data and performed background literature review: HDSS. Performed statistical analysis: SKN. Supervised results and discussion: EMK, IH and GH. All authors reviewed and approved the final version of the manuscript.

ACKNOWLEDGMENT

The authors would like to thank all the supervisors and all the research participants who willingly attended on the data collection, enabling the successful implementation of this study.

CONFLICT OF INTEREST

The authors declared there is no conflict of interest.

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