

ORIGINAL ARTICLE

CONTENTS

Point prevalence study of antibiotics use in Ramadi hospitals

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ABSTRACT

Aim: To describe antibiotic use in Al-Ramadi hospitals using the Biomérieux VITEK2 compact system.

Materials and Methods: A lot of different hospitals in Al- Ramadi were visited, checking Patients' illness profile. Information about antibiotics prescription pattern in Al- Ramadi hospitals had been collected from urinary tract infected patients using the Biomérieux VITEK2 compact system.

Results: Out of 67 specimens obtained from Urinary tract infection, fifty-two isolates were *E. coli*, eight isolates were *Klebsiella pneumoniae*, four were *Burkholderia cepacian*, and two were *Raoultella spp* and only one isolate *Acetobacter aceti*. The data analysis revealed that females had a higher prevalence of infection than males, with 41(68.30%) and 26(38.80%), respectively.

Conclusions: Resistance rates have shown variations over the years, they have typically remained elevated for antibiotics commonly employed in the empirical management of urinary tract infections. For successful treatment, it will be crucial to adjust therapy based on culture results and to consider resistance rates during empirical treatment.

KEY WORDS: antibiotic resistance, *E. coli, Klebsiella Pneumoniae*, urine cultures

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ABBREVIATIONS

AMs: Antimicrobial medicines
AMR: Antimicrobial resistance
HAIs: Hospital-Acquired Infections
WHO: World Health Organization
PPS: Point Prevalence Study
HRT: Hormone Replacement Therapy

INTRODUCTION

Antimicrobial medicines (AMs) are the pharmacological standard of care for infectious diseases. Any use of antimicrobials, especially antimicrobials (antibiotics), contributes to antimicrobial resistance (AMR), but misuse and overuse exacerbate resistance [1]. Antimicrobial-resistant infections can lead to severe illness and longer hospital stays, resulting in higher healthcare costs, medical errors, and mortality [2]. A systematic review found that antibiotic use was significantly higher in hospitals outside of Europe compared with those in Europe [3]. In hospitals, antibiotic therapy often has inadequate drug selection with respect to type of microorganism, route of administration, or duration of treatment [4]. As a result, most hospitalized patients either face potentially serious side effects or develop infections with resistant or difficult-to-treat pathogens (e.g., *Clostridium difficile*) without therapeutic response [5]. Hospitals can enhance their selection against antibiotic-resistant organisms through the frequent use of broad-spectrum antibiotics (e.g., cephalosporins, carbapenems), they also focus on common pathogens of hospital-acquired infections (HAIs), such as the group of (*Enterococcus faecium, Staphylococcus aureus, Klebsiella pneumoniae, Acinetobacter baumannii, Pseudomonas aeruginosa,* and *Enterobacter spp*.), leading to a vicious cycle of increased broad-spectrum antibiotic use [6]. The World Health Organization (WHO) Global Action Plan on Antimicrobial Resistance aims to strengthen surveillance and optimize antimicrobial prescribing [7]. These measures are being scaled up through interventions such as antimicrobial stewardship programmers (ASPs) in hospitals to improve clinical outcomes, ensure cost-effectiveness of antimicrobial therapy, and reduce the consequences of unintended use [8], however, the effort, coordination, and resources required to actively monitor hospital antimicrobial prescribing practices are high. Continuous collection of antibiotic prescribing data is not easy

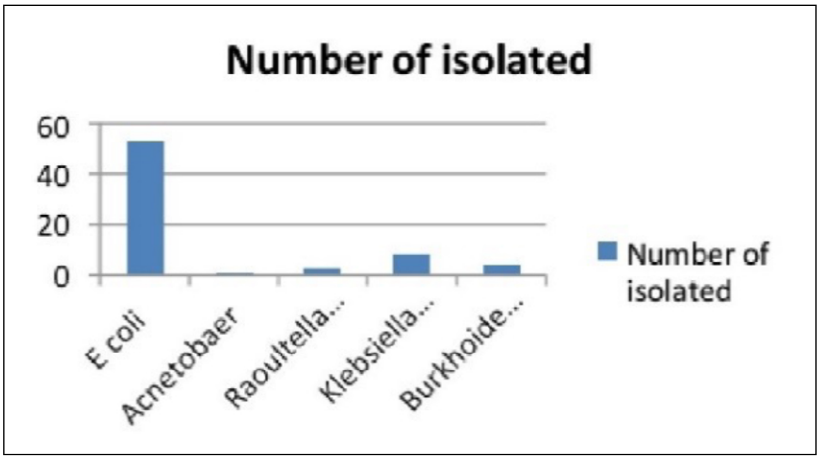

Fig 1. Distribution of bacteria from Urinary Tract infections (UTIs) patients

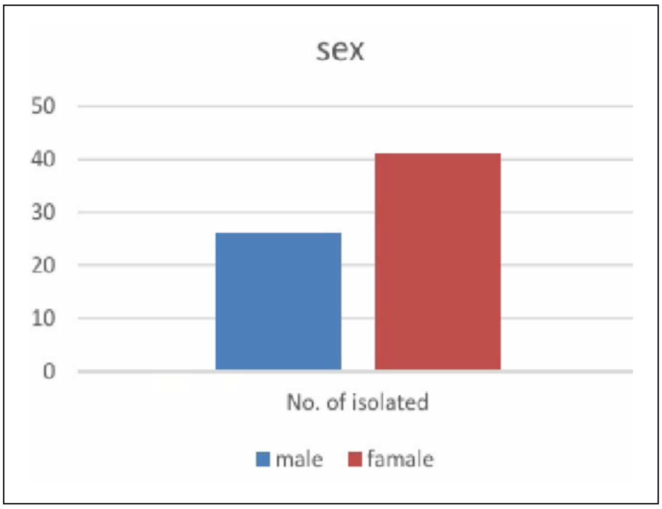

Fig. 2. Distribution of bacteria from Urinary tract infections (UTIs) patients. The data is presented in percentages based on gender criteria.

due to the high workload and resource requirements [9]. A feasible alternative is to collect data at specific time points. This can be done using a point prevalence study (PPS) approach, such studies can:

- Measure antibiotic consumption over time and assess changes in prescribing trends,
- Set quality improvement targets in different hospital departments,
- Evaluate the effectiveness of interventions implemented on response indicators identified in previous studies [10].

Point Prevalence Study evidence supports improving responsible use of antibiotics. Surveillance of hospital-acquired infections (HAIs) demonstrates the need for improved infection prevention and control, which forms the basis for combating antimicrobial resistance in healthcare settings. Point prevalence studies (PPS) are a useful approach to examine antibiotic prescribing patterns and identify targets for optimizing antibiotic use [11], therefore, the Global PPS Initiative and the WHO (WPPS) have proposed standardized methods for conducting PPS in hospitals [12].

AIM

The aim of this study is to describe antibiotic use in Al-Ramadi hospitals using the Biomérieux VITEK2 compact system.

MATERIALS AND METHODS

ISOLATION AND DETECTION OF BACTERIA

According to conventional procedures [13-14], all specimens were diagnosed microscopically (using Gram stain), morphologically, and biochemically. Commercial kits (VITEK2 gram negative and positive colorimetric identification kit) were used to perform several biochemical assays (BioMerieux, France).

ANTIBIOTICS SUSCEPTIBILITY

Antibiotics susceptibility tests by using the Biomérieux VITEK2 compact system (BioMerieux, France) against the following antibiotics: Cefotaxime, colistin, ceftazidim, cefipim, imepenem, meropenem, amikacin, tobramycin, gentamycin, trimethoprim / sulfamethaxazole, and ciprofloxacin.

STATISTICAL ANALYSIS

Data were analyzed using SPSS version 16 and Microsoft Office Word and Excel 2007. Nominal data were expressed as number and percent. Independent sample T-test was used for comparison of mean.

RESULTS

Out of 67 specimens obtained from different infection, 52 isolates were *E. coli*, 8 isolates were *Klebsiella pneumoniae*, 4 were *Burkholderia cepacian*, 2 were *Raoultella spp* and only one isolate *Acetobacter aceti* (Fig. 1). The data

Table 1. Distribution of infection according to the age

Age	No. of isolate	[%] of isolate
55-64	28	41.80%
45-54	14	20.90%
35-44	7	10.44%
25-34	5	7.46%
15-24	4	5.97%
5-14	4	5.97%
1-4	3	4.40%
<1	2	2.98%

analysis revealed that females had a higher prevalence of *infection* than males, with 41(68.30%) and 26(38.80 %), respectively Figure 2.

ANTIBIOTIC RESISTANCE PATTERN OF GRAM-NEGATIVE BACTERIA

As shown in Figure 3, the pattern of resistance was *Burkholderia* spp. resistant to cefotaxime, ciprofloxacin and colistin. E. coli was resistant to cefotaxime with moderate resistant to ciprofloxacin, K. pneumoniae were highly resistant to cefotaxime and colistin with moderate resistant to ciprofloxacin and gentamicin. *Acetobacte*r spp and *Raoutella* spp show highly resistant to cefotaxime, ciprofloxacin, colistin and gentamicin. In general, Gram-negative bacteria were more resistant to cefotaxime, with several species resistant to multiple antibiotic classes

Klebsiella pneumoniae, Burkholderia cepacian, Raoultella spp and *Acetobacter aceti* highly resistance to most of antimicrobial agents mainly cefotaxime, ciprofloxacin, colistin while *E. coli* show moderate resistance to ciprofloxacin and sensitive to gentamycin and colistin. The percentage of resistant isolates to each antibiotic is shown in Figure 3.

Age is a significant risk factor for UTI in both MDR and non-MDR patients. In the MDR group, the highest incidence of UTI was found in people aged 55-64 years as shown in Table 1 that represent the highest incidence of UTIs among MDR patients was observed in those 55-64 years old. In general, women had a higher incidence of UTIs in both MDR and non-MDR patients compared to men. Additionally, the primary bacteria responsible for infections in both MDR and non-MDR patients were Gram-negative *E. Coli*.

DISCUSSION

Through our research conducted between 18, Nov. 2024 to 10 Dec. 2024 in Ramadi hospitals, we detected antibiotic-resistant bacteria mainly *E. coli* and *Klebsiella pneumoniae*. We found significant resistance of bacteria to antibiotics, indicating the misuse of antibiotics and improper prescription by physicians and healthcare professionals in acute cases. These findings suggest a serious responsibility in handling antibiotics in hospitals in terms of frequent prescription, cases where these drugs are not prescribed according to guidelines, and pharmacists dispensing these antibiotics illegally without a prescription, leading to the widespread spread of bacterial resistance through transmission or misuse [15], therefore, we propose that the Iraqi Ministry of Health install legal signage and monitor improper prescriptions by physicians and pharmacists, holding violators accountable. This resistance is projected to be fatal to millions of people by 2050, with an estimated 10 million deaths due to antibiotic resistance. *E. coli, K. pneumoniae,* and *Acinetobacter* spp., all Gram-negative bacteria, were prevalent in UTI patients in our study [16]. Among these, *E. coli* was the most common. After comparing our results with the study "Prevalence and pattern of antibiotic use and resistance among Iraqi patients: a cross-sectional study" published in the African Health Sciences which examined a number of bacteria in 850 patients, we found similar infection rates for the same types of bacteria we detected: *Escherichia coli*: 123(14.5%), *Klebsiella Pneumonia*: 11(1.29%), Gentamycin: 103(12.11%), Ciprofloxacin: 345(40.58%), Cefotaxime: 209(24.58%) [17]. Our research has revealed a significant increase in antibiotic resistance among bacteria, a trend that poses a serious threat to public health. A comparison of our findings with previous studies shows a concerning disparity, with resistance rates in Ramadi hospitals being notably higher for Cefotaxime at 75% compared to the 24.58% reported in compared study and for Ciprofloxacin we see that our research note 50% comparing with compered study 40.58% it higher, but for Gentamycin we note 0% resistance but in compared study we see it 12.11% and that mean there is no resistance of gentamycin in Ramadi hospital and it good for patient who used it to treating from E-coli [16]. As our study showed, gender plays a crucial role in the risk of UTI. *Escherichia coli* and *Klebsiella pneumoniae* were the most common bacteria found in both male and female patients. Notably, *E. coli* was more frequent in females 45% than in males 30%. This observation is consistent with previous studies [18] suggesting that anatomical differences, especially the proximity of the anus to the female urethra, may facilitate bacterial migration and colonization [19]. Hormonal changes, such as the decline in estrogen after menopause, can also increase the risk of UTI, which is why hormone replacement therapy (HRT)

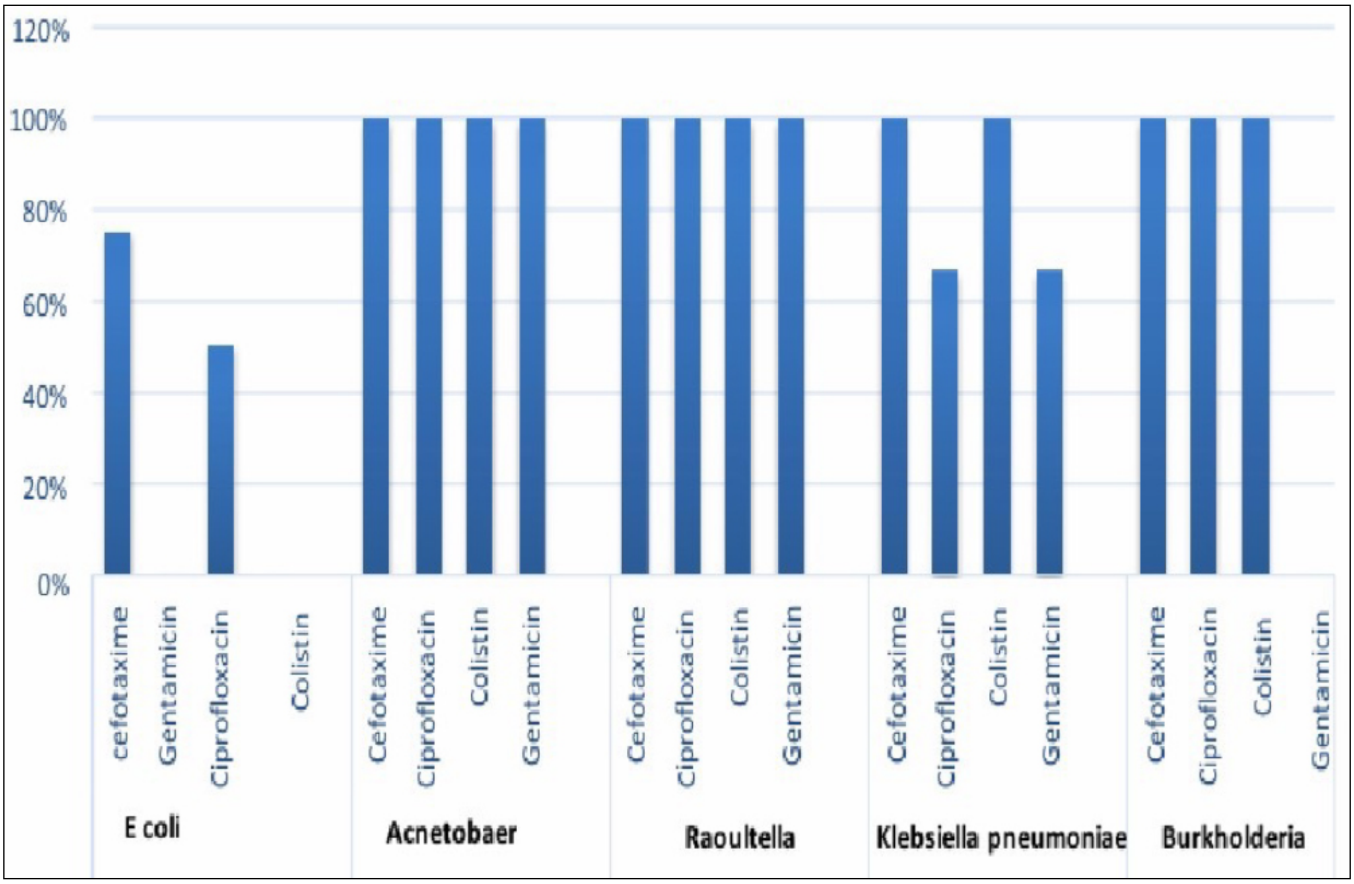

Fig. 3. Antibiotic resistance pattern of Gram-negative bacteria.

is a valuable preventive measure in postmenopausal women [20]. Hormone replacement therapy (HRT) can affect urinary tract infections (UTIs), especially in postmenopausal women. Decreased estrogen levels after menopause can affect urinary tract health and may increase the frequency of UTIs. HRT, particularly estrogen therapy, can relieve menopausal symptoms and improve urinary tract health, potentially reducing the incidence of UTIs. However, the link between HRT and UTIs is complex and varies from person to person. Some studies have shown a benefit, while others have shown no significant effect or a possible increased risk of UTIs. Multiple factors, including urine patterns, hygiene habits, and underlying health conditions, contribute to the risk of UTIs [21]. Good hygiene and hydration are other effective strategies to minimize the risk of infection [18]. Our study found that Gram-negative bacteria, including *E. coli*, are multidrug resistant, and the resistance these bacteria exhibit is mainly due to β-lactam resistance. The thick peptidoglycan coating of *E. coli* and the production of biofilms help it adhere to the walls of the urinary system and develop antibiotic resistance [22]. The presence of β-lactamases in *E. coli* provides protection against antibiotics [23]. In addition, excessive use of antibiotics can cause side effects such as diarrhea and allergic reactions, making treatment ineffective [24]. Age is a significant risk factor for UTI in both MDR and non-MDR patients. In the MDR group, the highest incidence of UTI was found in people aged 55-64 years. Elderly people are more susceptible to comorbidities due to known risk factors for UTI such as diabetes and hypertension. In addition, gender and bacterial etiology play an important role in the risk level of UTI, with women facing a higher risk due to anatomical differences, and Gram-negative bacteria being the leading cause of UTI in both MDR and non-MDR cases [24]. Our research aligns with findings from Özlem Aytaç, who discovered that *K. pneumoniae* exhibited the highest resistance to cefixime at 53.3%, while its lowest resistance was noted against imipenem at 12.1%. The samples collected from outpatients showed the least resistance, whereas the ward patients exhibited the greatest resistance rates, particularly to cefixime at 81% and ciprofloxacin at 72.1%. Additionally, higher resistance levels were observed in intensive care patients for ertapenem at 48.9%, meropenem at 50.2%, and piperacillin-tazobactam (PRP) at 57.3%.

Our study identified MDR in Gram-negative bacteria, including E. coli, which exhibited 100 % resistance, primarily due to beta-lactam resistance, The thick peptidoglycan coating of E. coli, along with biofilm production, contributes to its ability to adhere to urinary system walls and develop antibiotic resistance [21]. The presence of beta-lactamase enzymes in E. coli provides defense against antibiotics, in addition, overuse antibiotics have side effects such as diarrhea, allergic reaction and become ineffective in treating [23].

CONCLUSIONS

The current study showed high rates of resistance among clinical isolates of urine origin. In particular, resistance to cefotaxime, ciprofloxacin, and colistin was high (100%) across all crop species. That represent the highest incidence of UTIs among MDR patients was observed in those 55-64 years old. In general, women had a higher incidence of UTIs in both MDR and non-MDR patients compared to men with 41(68.30%) and 26(38.80 %), respectively .The gradual replacement of drugs once considered first-line treatment with broad-spectrum drugs such as cephalosporins, fluoroquinolones, and aminoglycosides remains an ongoing challenge in Iraq, an issue that has led to poor antimicrobial stewardship, especially in resource-poor primary health care settings. Scarce and excessive antimicrobial drugs are less affected by established antimicrobial stewardship programs. Our findings reveal another worrying issue associated with these broad-spectrum antibiotics, which were previously considered a last resort. Among urinary pathogens, resistance to cephalosporins, fluoroquinolones, and aminoglycosides was high (100%). Thus, despite being considered last-resort agents, these agents might become increasingly ineffective in the treatment of resistant infections under current prescription practices.

This study highlights the significance of using antibiotics rationally, the need for vigilant monitoring of local epidemiological data, and the importance of implementing necessary precautions. Additionally, it is essential to remember that reevaluating each treatment based on the antimicrobial susceptibility profile is vital for enhancing treatment success and reducing resistance rates, especially given the elevated resistance rates associated with antibiotics commonly employed in the empirical management of UTIs.

ETHICAL APPROVAL

This study has been approved by Al Maarif University, College of Pharmacy Research Ethics Committee (approval date 9/12/2024, number 388).

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CONFLICT OF INTEREST

The Authors declare no conflict of interest

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A – Work concept and design, B – Data collection and analysis, C – Responsibility for statistical analysis, D – Writing the article, E – Critical review, F – Final approval of the article

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