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PREVALENCE AND ANTIBIOTIC SUSCEPTIBILITY PROFILE OF ISOLATED BLSE-PRODUCING KLEBSIELLA SPP IN URINARY TRACT INFECTIONS AT FANN NATIONAL UNIVERSITY HOSPITAL (DAKAR/SENEGAL)

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ABSTRACT: *This is a retrospective study covering the period 2022-2023 on urine samples received at the bacteriology-virology laboratory of the CHNU of FANN. The aim was to determine the prevalence and sensitivity profile of ESBL-producing strains of Klebsiella spp to other antibiotic molecules. A total of 549 urine samples were positive for a bacterium, of which 113 (20.58%) were attributable to Klebsiella spp., with a predominance of Klebsiella pneumoniae n=90 (79.65%). 59.26% were producers of extended-spectrum betalactamase (ESBL), of which 56.25% (n=27/48) were of hospital origin. Good sensitivity was noted to imipenem (78.40%) and amikacin (70.59%).*

KEYWORDS: ESBL, *Klebsiella spp*, Urinary tract, Antibiotics.

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INTRODUCTION

Urinary tract infections (UTI) are a major public health problem [1]. Indeed, they are among the most frequent pathologies in both community and hospital settings, and represent a heavy burden in terms of cost and morbimortality for society [2]. *Klebsiella spp*. feature prominently among the bacteria involved in these infections [2,3,5]. In recent years, the massive use of antibiotics has favored the selection, emergence and dissemination of multi-resistant uropathogenic bacteria, sometimes resulting in therapeutic failure [6]. These include resistance to third-generation cephalosporins (C3G) through the acquisition of extended-spectrum betalactamases (ESBL), and to fluoroquinolones, the molecules of choice for the treatment of urinary tract infections [7], making it essential to readapt antibiotic therapy protocols. It is in this context that we conducted this study, the aim of which was to determine the prevalence and sensitivity profile of ESBL-producing strains of *Klebsiella spp*. in relation to other families of antibiotics.

METHODOLOGY

This was a retrospective study covering the period 2022-2023, based on urine samples received at the bacteriology-virology laboratory of FANN CHNU. Bacterial identification was carried out using the standard method for determining phenotypic (morphological and biochemical) characteristics. Antimicrobial susceptibility testing was carried out using the agar diffusion method, in accordance with the recommendations of the Comité de l'Antibiogramme de la Société Française de Microbiologie CA-SFM 2022. ESBL testing was performed using the synergy test between an amoxicillin + clavulanic acid disc and one of the cefotaxime, ceftriaxone or ceftazidime discs, characterized by a “champagne cork” image. Other antibiotic classes tested for co-resistance include aminoglycosides, fluoroquinolones, cotrimoxazole, nitroxoline and fosfomycin. Patient data were extracted from the laboratory register, entered into Excel and analyzed using SPSS IBM 25 software.

RESULTS

Of a total of 2412 urine samples collected, 549 were positive, representing a positivity rate of 22.76% (figure1). The median age of included patients was 57 years with a male predominance (51.90%) according to a sex ratio of 1.8 (Table I).

The study population was predominantly outpatients (60%) (Figure 2).

Klebsiella spp. infections of the urinary tract were 20.58% (n=113), with a predominance of Klebsiella pneumoniae n=90 (79.65%) (figure 3).

Among the *Klebsiella spp* strains isolated, 59.26% were producers of extended-spectrum betalactamases (ESBLs). The sensitivity profile of ESBL-producing Klebsiella strains to the different classes of antibiotics was variable. With regard to the other antibiotic molecules tested, imipenem retained good activity on ESBL-producing *Klebsiella* strains (78.40%), while amikacin was more active (70.59%) and gentamicin and tobramycin had lower, similar activity (51%). With regard to quinolones, norfloxacin was the most active (54.29%), followed by

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levofloxacin (51.43%), pefloxacin (42.86%) and ciprofloxacin (41.67%), while the combination of trimethoprim and sulfamethoxazole was less active (33.34%) (figure 4). The majority of ESBL-producing *Klebsiella* strains were of hospital origin (n=27/48), and there was a significant difference in susceptibility to levofloxacin between community- and hospital-acquired ESBLs, with a p-value of 0.023.

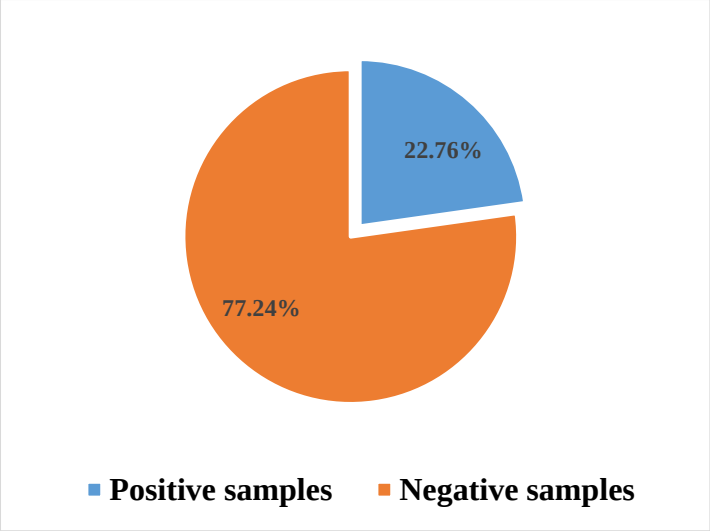

Figure 1: Prevalence of urinary tract infections

Table I: Age Distribution of Study Population

Age groups (years)	Number	Percentage (%)
<30	606	30,5
30 - 45	355	17,9
46 - 60	278	14
61 - 85	707	35,6
>85	41	2,1

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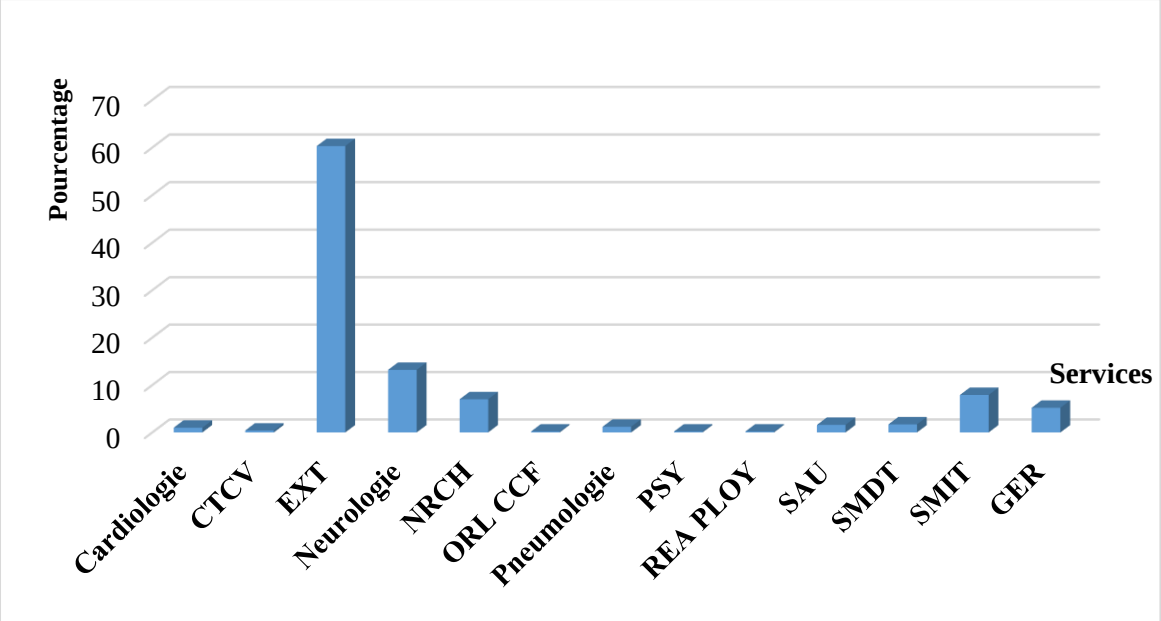

Figure 2: Distribution of patients by origin

CTCV: Thoracic and cardiovascular surgery

EXT: External

NRCH: Neurosurgery

CCF: Cervicofacial Surgery

PSY: Psychiatry

GER: Geriatrics

SAU: Emergency department

SMIT: Department of Infectious and Tropical Diseases

SMDT: Occupational Medicine Department

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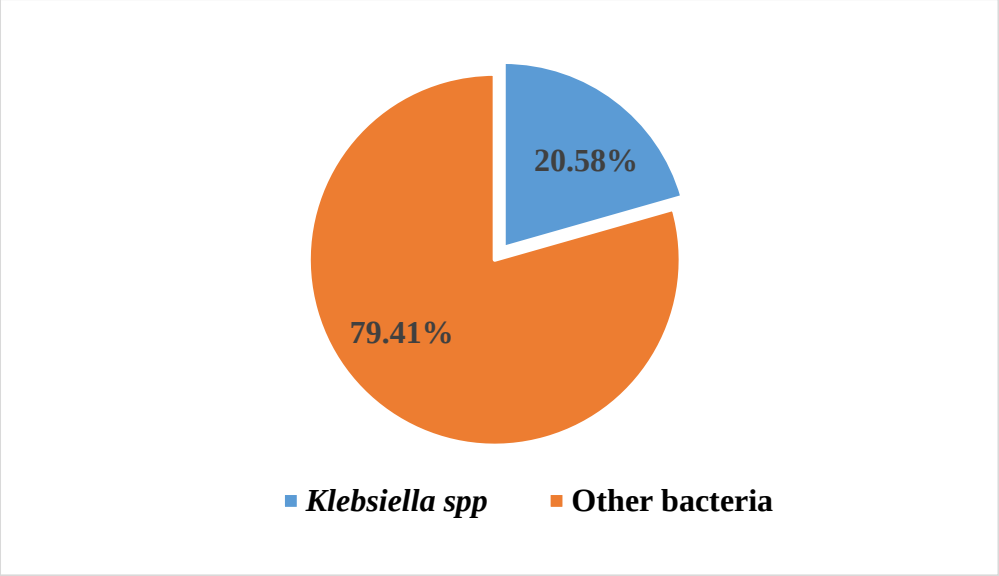

Figure 3: Prevalence of *Klebsiella spp*. urinary tract infections

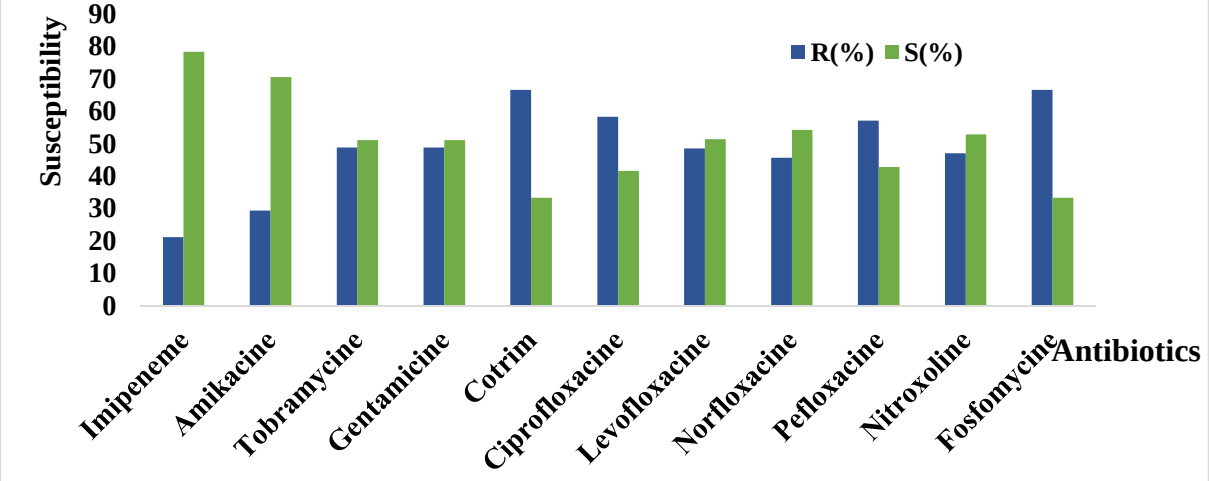

Figure 4: Susceptibility profile of ESBL-producing *Klebsiella spp* to other antibiotic families

DISCUSSION

Our study showed a 22.76% prevalence of *Klebsiella spp* urinary tract infections.Similar results were obtained with the study by Hailaji et al. (2016) on the antibiotic susceptibility of uropathogenic bacteria in the city of Nouakchott, with a prevalence of *Klebsiella spp* of 24.1% [8]. *Klebsiella spp* remains the bacteria most implicated in urinary tract infections after *Escherichia coli* according to the literature [9] .

On the other hand, lower values were noted in the study by Lahlou Amine et al. (2009) on the epidemiology and antibiotic resistance of enterobacteriaceae isolated from urinary tract infections at the Moulay-Ismail military hospital in Meknes, where the prevalence of *Klebsiella spp* was 10% [10]. In addition, weaker results were found in other studies [11], with a high

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level of resistance to betalactam antibiotics, with 59.26% of *Klebsiella spp* strains producing ESBL. This result is similar to data obtained elsewhere, such as the study on "Microbial ecology and antibiotic susceptibility of bacteria isolated from urinary tract infections in children in Morocco in 2019", with a predominance of *Klebsiella pneumonia* in the arsenal of ESBL-producing Enterobacteriaceae (47%) and many others[12, 14]. However, the 2014 study by Romli et al. showed a lower rate of ESBL-producing *Klebsiella spp* strains at 25% [15]. The majority of strains were of hospital origin (n=27/48). On the one hand, this may be explained by the frequency of urinary tract infections in hospitals, in relation to risk factors for nosocomial infections such as bladder catheterization, and hand-carried transmission of germs during urinary catheter insertion or maintenance [16]. In addition, as some authors have reported, recent antibiotic therapy (< 3 months), particularly with C3G, and recent hospitalization are risk factors for ESBL-producing enterobacteriaceae [17]. Paradoxically, a higher rate of community-acquired ESBL was obtained in other studies [18]. Sensitivity to ciprofloxacin was (41.67%), giving a resistance rate of 58.38%, much higher than the results of Romli et al. with a resistance rate of 33.6% [15]. This loss of ciprofloxacin activity may be explained by the increased consumption of fluoroquinolones, linked to the selection of resistant mutants [19]. On the other hand, more alarming results were obtained for the combination sulfamethoxazole / trimethoprim or cotrimoxazole (88.4%) and ciprofloxacin (92.5%) [20]. In our study, we noted a good sensitivity of ESBL-producing *Klebsiella spp* strains to amikacin (70.59%). In contrast, much higher rates of resistance (51%) to amikacin were obtained by Bouamri et al. in 2014, who also showed high resistance to gentamicin (74%) [21]. Concerning carbapenems, good activity was noted with imipenem (78 ,40%), i.e. a resistance rate of around (20%). This high rate of resistance is thought to be linked to the frequent use of carbapenems, which are currently the only molecule available that remains consistently effective on E-BLSE in the absence of an associated resistance mechanism [22]. Moreover, this resistance to imipenem is higher than that observed by Bouamri et al. (2012), with a resistance rate of 10%. This discrepancy is undoubtedly in contradiction with data reported elsewhere, where carbapenems have very good activity against EBLSE [23]. Overall, imipenem and amikacin remain the most active antibiotics against ESBL-producing Klebsiella spp in our context. Similarly, this observation is in line with the results of a study on the prevalence of extended-spectrum beta-lactamase-producing Enterobacteriaceae strains isolated in Togo and their susceptibility to antibiotics, in which imipenem and amikacin were highly active on the strains [24]. At our level, fosfomycin had a low activity on ESBL-*producing Klebsiella spp* (33%), contrary to literature data [20, 25].

CONCLUSION

Our study has shown that *Klebsiella spp*. are highly resistant to betalactam antibiotics, with a predominance of ESBL-secreting strains. However, amikacin and imipenem remain the most active molecules against ESBL-producing strains in our context. This high level of resistance highlights the need to rationalize the correct use of antibiotics, with particular emphasis on carbapenems, which occupy a very important place in the therapeutic arsenal, and the emergence of their resistance compromises the use of an entire family of antibiotics, including the Betalactamins.

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