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Original Research

Four-Year Trends of Uropathogen Prevalence and Antimicrobial Resistance in Eastern Libya

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ABSTRACT:

Urinary tract infections (UTIs) are among the most common bacterial infections, and increasing antimicrobial resistance (AMR) has become a major challenge to effective treatment. This study evaluated the prevalence of Uropathogen and their antimicrobial susceptibility patterns at Tobruk Medical Centre, Libya, over a four-year period. A retrospective analysis was conducted on 6,032 urine samples collected between January 2021 and December 2024. Bacterial isolates were identified using standard microbiological methods, and antimicrobial susceptibility testing was performed by the Kirby–Bauer disk diffusion method according to CLSI guidelines. Of the 6,032 samples, 1,264 (20.95%) yielded significant bacterial growth. Gram-negative bacteria predominated

(81.8%), with *Escherichia coli* (49.36%) as the most common isolate, followed by *Klebsiella* spp. (16.85%) and *Staphylococcus aureus* (14.79%). Nitrofurantoin demonstrated the highest overall activity against most Uropathogen, whereas resistance to several commonly prescribed antibiotics increased during the study period, indicating an emerging multidrug-resistant trend. Uropathogen isolated at Tobruk Medical Centre showed substantial antimicrobial resistance, highlighting the need for routine culture-based susceptibility testing, continuous local AMR surveillance, and strengthened antibiotic stewardship to optimize empirical treatment strategies.

KEYWORDS: Urinary Tract Infections (UTIs), Antimicrobial Resistance, Uropathogen, Bacterial Isolates, Libya.

INTRODUCTION

Urinary tract infections (UTIs) represent a significant health challenge in both community-acquired and nosocomial settings, particularly among women. If left untreated, UTIs can escalate into severe systemic complications, including pyelonephritis, permanent renal scarring, and chronic kidney disease. Furthermore, UTIs are a primary precursor to Gram-negative bacteremia and urosepsis across all age groups, contributing to high morbidity and mortality rates, while imposing a substantial financial burden on healthcare systems globally. The etiology of UTIs is characterized by a predictable yet evolving spectrum of Uropathogen. Gram-negative bacilli are the most frequent isolates, with Uropathogenic *Escherichia coli* (UPEC) remaining the dominant causative agent. Other significant isolates include *Proteus* species, *Pseudomonas aeruginosa*, *Acinetobacter* species, *Klebsiella* species, *Enterobacter* species, and *Citrobacter* species. Among Gram-positive bacteria, *Staphylococcus saprophyticus*, *Enterococcus* species, and coagulase-negative *Staphylococci* (CoNS) are commonly identified, particularly in complicated and catheter-associated cases. In recent decades, the management of UTIs has been severely compromised by the global surge in antimicrobial resistance (AMR). Infections caused by resistant strains are inherently linked to poorer clinical outcomes, including prolonged hospitalizations and increased intensive care unit (ICU) stays (Kollef, 2003). Because the distribution and susceptibility patterns of these microorganisms fluctuate significantly over time and across different geographical locations (Clinical and Laboratory Standards Institute, 2012), empirical treatment is becoming increasingly difficult and often leads to therapeutic failure. The escalating profile of antibiotic resistance in uropathogens is not merely a phenotypic shift but is rooted in complex genetic adaptations. Resistance to beta-lactam antibiotics, for instance, is primarily mediated by the production of various enzymes, most notably Extended-Spectrum beta-Lactamases (ESBLs) such as the CTX-M, TEM, and SHV families. These enzymes hydrolyze the beta-lactam ring, rendering penicillins and

cephalosporins ineffective. Furthermore, the emergence of Carbapenem-Resistant Enterobacteriaceae (CRE), which utilize mechanisms like the production of KPC (*Klebsiella pneumoniae* carbapenemase) or NDM-1 (New Delhi metallo-beta-lactamase), has severely limited the "last-resort" therapeutic options available to clinicians. Beyond enzymatic degradation, uropathogens employ efflux pump systems (e.g., the AcrAB-TolC system in *E. coli*) that actively expel antibiotic molecules from the bacterial cell, thereby reducing their intracellular concentration below lethal levels. Mutations in the Quinolone Resistance-Determining Regions (QRDRs) of DNA gyrase and topoisomerase IV genes also play a pivotal role in the widespread resistance to fluoroquinolones, which were previously the mainstay of UTI therapy.

A critical factor in the persistence and recurrence of UTIs, particularly in catheterized patients, is the ability of uropathogens to form biofilms. A biofilm is a structured community of bacterial cells enclosed in a self-produced extracellular polymeric substance (EPS) matrix. This matrix acts as a physical barrier that restricts the penetration of antimicrobials and protects the bacteria from host phagocytosis. Consequently, bacteria within a biofilm can exhibit a resistance level up to 1,000 times higher than their planktonic counterparts, leading to chronic infections that are notoriously difficult to eradicate.The dynamic nature of uropathogen resistance necessitates a transition from generalized treatment protocols to data-driven, localized therapeutic strategies. There is an urgent need for regular monitoring of local antibiotic susceptibility profiles to guide clinical decision-making. Identifying the specific distribution of causative agents and their current resistance patterns is essential for optimizing patient care, reducing the incidence of complications, and implementing robust antibiotic stewardship programs to preserve the efficacy of the remaining antimicrobial arsenal.

MATERIALS AND METHODS

Study Population

This study involved 6032 patients clinically suspected of urinary tract infection (UTI). who attended Tobruk Medical Centre. The cohort included 3294 females and 2738 males. Which showed 1264 positive culture and 4768 negative culture in samples collection. All clinical samples obtained from various departments, including both inpatient and outpatient departments (OPD), and to determine the antimicrobial susceptibility patterns of the isolates. All urine samples collected during the study period, from January 2021 to December 2024, were included in the analysis at the Microbiology Laboratory of the Tobruk Medical Center.

Specimen collection

The samples were collected in clean dry container, In case of babies, urine collecting bag is favorable and Collection of urine by use of a single catheter (straight catheter technique) Specimens were cultured on cysteine lactose electrolyte deficient ***(***CLED***)*** agar, BLOOD agar, MacConkey agar and nutrient agar and sterile calibrated disposable loops.

and incubated at 37°C for 24hrs. Characteristic bacterial pathogens colonies were identified by Gram stain, catalase, and coagulase testing according to standard bacteriological procedures.

Antimicrobial Susceptibility Testing

Susceptibility testing was performed briefly

overnight cultures of isolates on Mueller Hinton agar incubated at 37 °C for 24 h were used for making bacterial suspensions in 0.85% NaCl and adjusted to McFarland 0.5 turbidity standards prepared suspensions were used for inoculation of the Mueller Hinton agar plate's surface, afterward the antibiotic discs were placed on the inoculated agar surface. After the incubation period of 24 h at 37°C, the inhibition zones around the discs were measured and interpretation of the inhibition zone values (S-sensitive, I-intermediate and R-resistant) was based on the standards guideline's instructions. Antibiotics discs used and their concentrations as the following Cefoxitin (30µg), Nalidixic acid (30µg), gentamycin (10µg), Augmentin (30µg), Ampicillin (10µg), Amikacin (30µg), Trimethoprim / Sulfamethoxazole (25µg), Tetracycline (30µg), Cephalothin (30µg), Cefotaxime (30µg), Nitrofurantoin (300µg), and **Ciprofloxacin** (5µg).

RESULTS AND DISCUSSION

Out of the 6,032 urine samples were screened from both inpatient and community settings. Females represented 54.60% (n=3,294) of the cohort, while males accounted for 45.39% (n=2,738) Table 1. Over the four-year study period, 1,264 samples tested positive for urinary tract infections (UTI). The annual positivity rate showed a gradual decline from 24.27% in 2021 to a minimum of 17.89% in 2024 Table 2. Gram-negative bacteria were the primary etiological agents, comprising 81.80% (n=1,034) of total isolates, compared to 18.19% (n=230) for Gram-positive pathogens Table 3. *Escherichia coli* was the most prevalent isolate (49.63%), followed by *Klebsiella* spp. (16.85%) and *Staphylococcus aureus* (14.79%). Other isolates included *Proteus* spp., *Pseudomonas* spp., and relatively low frequencies of *S. epidermidis*, *Enterococcus* spp., and *Streptococcus* spp. Table 4. The susceptibility profiles exhibited significant temporal variations between 2021 and 2024: Gram-Positive Isolates: Nitrofurantoin consistently showed high efficacy during 2021-2022 (approx. 60% sensitivity). However, sensitivity patterns shifted by 2023-2024, with Cefoxitin emerging as the most effective agent (13.4%–16.6%). Resistance was most pronounced against Cefoxitin in 2022 (86%) and Augmentin/Gentamicin in 2024 (34.84%). Gram-Negative Isolates: In the initial phase (2021), Ciprofloxacin and Nitrofurantoin were the most effective (sensitivity >52%). By 2024, Nitrofurantoin and Augmentin demonstrated the highest sensitivity rates (91.19% and 85.55%, respectively). Conversely, the highest resistance rates were observed against Clarithromycin (72.89% in 2022), Augmentin (40% in 2023), and Gentamicin (31.56% in 2024). Detailed susceptibility and resistance data across the study years are documented in Table 5, 6, 7 and 8.

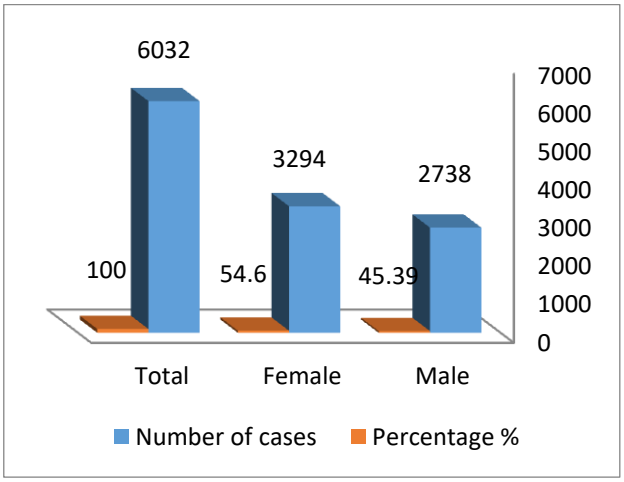

Figure (1). Number of included cases from 2021 to 2024 presented as gender at Tobruk Medical Center

Gender	Number of cases	Percentage %
Male	2738	45.39
Female	3294	54.60
Total	6032	100

Table:(1). Frequency Distribution of the samples according to Gender.

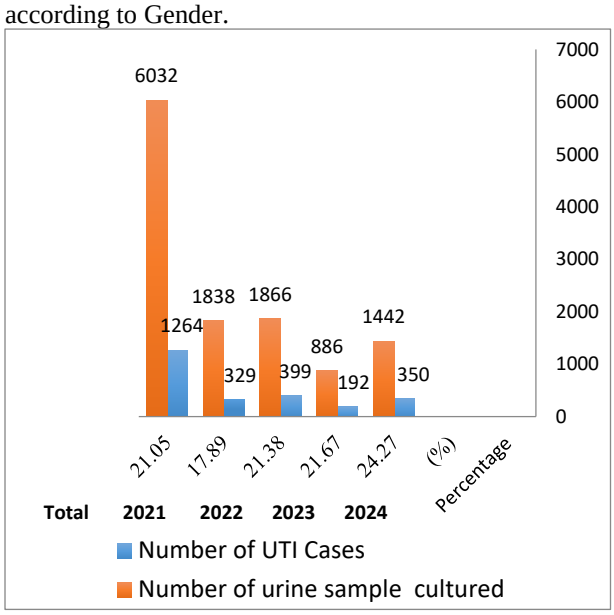

Figure (2). Total urine samples cultured showing UTI cases distributed over study period years.

Table:(2). Yearly distribution of urine cultures and UTI-positive cases.

Year	Number of urine sample cultured	Number of UTI Cases	Percentage (%)
2021	1442	350	24.27
2022	886	192	21.67
2023	1866	399	21.38
2024	1838	323	17.57
Total	6032	1264	20.95
			100

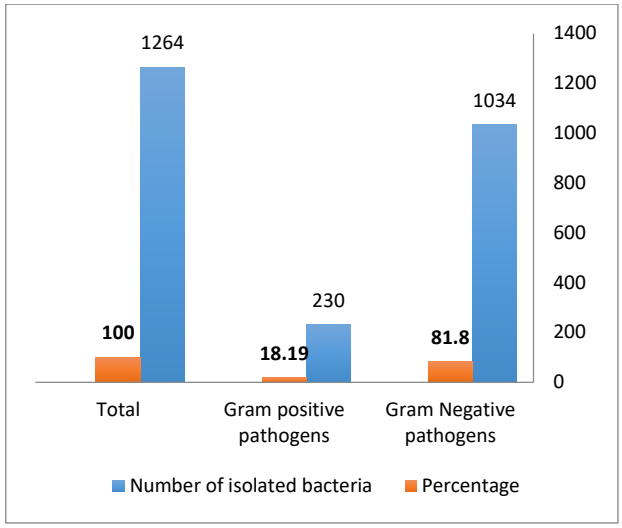

Figure (3). Prevalence of Gram negative and Gram positive uropathogens over all period of this study.

Table:(3). Prevalence of Gram negative and Gram positive uropathogens.

	Gram **Negative** pathogens	Gram **positive** pathogens	Total
Number of isolated bacteria	1034	230	1264
Percentage **%**	81.80	18.19	100

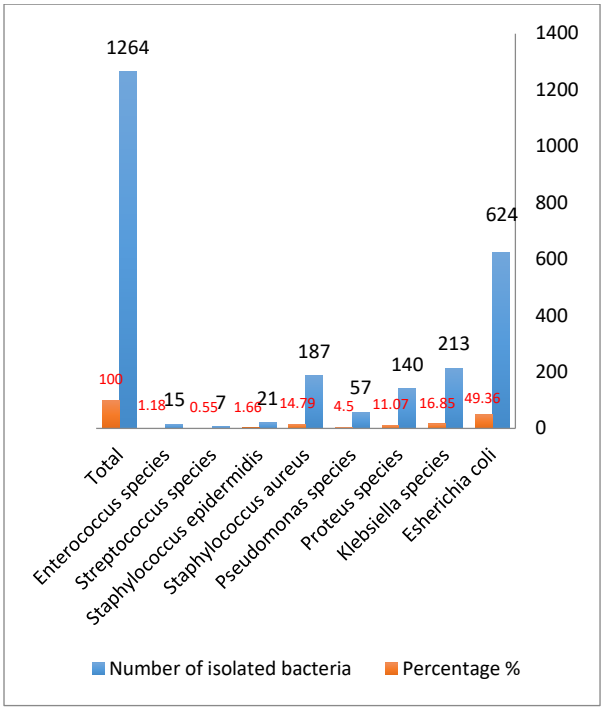

Figure (4). Names, numbers and the percentage of uropathogenic bacterial species.

Table:(4). Overall prevalence of Gram-negative and Gram-positive bacterial isolates.

Name of Bacteria	Number of isolated bacteria	Percentage %
Escherichia coli	624	49.36
Klebsiella species	213	16.85
Proteus species	140	11.07
Pseudomonas species	57	04.50
Staphylococcus aureus	187	14.79
Staphylococcus epidermidis	21	01.66
Streptococcus species	7	00.55
Enterococcus species	15	1.18
Total	1264	100

Table:(5). Antibacterial agents and urine isolated pathogens showing their sensitivity and resistance results, in 2021 (*R resistance, S sensitivity, - Not tested*).

Antimicrobial Agents / Symbols 2021	Gram Positive pathogens n= 47		Gram Negative pathogens n=300	
	R No. (%)	S No. (%)	R No. (%)	S No. (%)
Cefoxitin (FOX)	14 (29.79)	11 (23.40)	49 (16.33)	68 (22.66)
Ciprofloxacin (CIP)	6 (12.77)	21 (44.68)	63 (21)	106 (35.33)
Nitrofurantoin (F)	2 (4.26)	28 (59.57)	59 (19.67)	156 (52)
Clarithromycin (CL)	6 (12.77)	3 (6.38)	89 (29.67)	20 (6.66)
Gentamicin (CN)	15 (31.91)	8 (17.02)	78 (26)	44 (14.66)
Ceftazidime (CAZ)	17 (36.17)	4 (8.51)	89 (29.66)	97 (32.33)
Trimethoprim /Sulphamethoxazole (SXT)	-	-	91 (30.33)	53 (17.66)
Amoxycillin Clavulanic acid (AMC)	1 (2.13)	14 (29.79)	39 (13)	36 (12)
Ampicillin (AMP)	3 (6.38)	2 (4.26)	46 (15.33)	4 (1.33)
Tetracycline (TE)	2 (4.26)	1 (2.13)	71 (23.67)	47 (15.66)
Cephalothin (KF)	5 (10.64)	16 (34.04)	82 (27.33)	14 (4.66)

Table:(6). Antibacterial agents and urine isolated pathogens showing their sensitivity and resistance results, in 2022 (*R resistance, S sensitivity, - Not tested*).

Antimicrobial Agents / Symbols 2022	Gram Positive pathogens n= 25		Gram Negative pathogens n=166	
	R No. (%)	**S No. (%)**	**R No. (%)**	**S No. (%)**
Cefoxitin (FOX)	17 (68)	2 (8)	36 (21.68)	84 (50.60)
Ciprofloxacin (CIP)	8 (32)	0	21 (12.65)	19 (11.44)
Nalidixic acid (NA)	–	–	73 (43.98)	26 (15.66)
Nitrofurantoin (F)	4 (16)	15 (60)	39 (23.49)	62 (37.34)
Clarithromycin (CL)	18 (72)	3 (12)	121 (72.89)	6 (3.61)
Cefamandole (MA)	7 (28)	6 (24)	80 (48.19)	26 (15.66)
Ceftazidime (CAZ)	15 (60)	3 (12)	49 (29.52)	40 (24.09)
Pefloxacin (PEF)	9 (36)	8 (32)	49 (29.52)	58 (34.93)

Table:(7). Antibacterial agents and urine isolated pathogens showing their sensitivity and resistance results, in 2023 (*R resistance, S sensitivity, - Not tested*).

Antimicrobial Agents / Symbols 2023	Gram Positive pathogens n= 92		Gram Negative pathogens n=305	
	R No. (%)	S No. (%)	R No. (%)	S No. (%)
Cefoxitin (FOX)	48 (52.17)	12 (13.04)	49 (16.07)	71 (23.2)
Ciprofloxacin (CIP)	23 (25)	22 (23.91)	49 (16.07)	83 (27.2)
Nitrofurantoin (F)	28 (30.43)	32 (34.78)	57 (18.69)	88 (28.8)
Amikacin (AK)	2 (2.17)	0	23 (7.54)	0
Nalidixic acid (NA)	19 (20.65)	2 (2.17)	30 (9.84)	19 (6.22)
Ceftazidime (CAZ)	25 (27.17)	0	0	0
Trimethoprim/Sulphamethoxazole (SXT)	1 (1.09)	1 (1.09)	100 (32.79)	35 (11.4)
Amoxycillin Clavulanic acid (AMC)	35 (38.04)	9 (9.78)	125 (40.98)	14 (4.59)
Ampicillin (AMP)	15 (16.30)	5 (5.43)	40 (13.11)	15 (4.91)
Cephalothin (KF)	7 (7.60)	2 (2.17)	16 (5.25)	0

Table:(8). Antibacterial agents and urine isolated pathogens showing their sensitivity and resistance results, in 2024 (*R resistance, S sensitivity, - Not tested*).

Antimicrobial Agents / Symbols 2024	Gram Positive pathogens n= 66		Gram Negative pathogens n=263	
	R No. (%)	S No. (%)	R No. (%)	S No. (%)
Cefoxitin (FOX)	4 (6.06)	11(16.67)	58 (22.05)	49 (18.63)
Ciprofloxacin (CIP)	3 (4.55)	6 (9.09)	44 (16.73)	39 (14.83)
Nalidixic acid (NA)	0	1(1.52)	0	6(2.28%)
Nitrofurantoin (F)	12 (18.18)	11(16.67)	126 (47.9)	168 (63.88)
Amoxicillin &Clavulanic acid (AMC)	23 (34.85)	6 (9.09)	47 (17.87)	225 (85.55)
Ampicillin (AMP)	9 (13.64)	1 (1.52)	4 (1.52)	92 (34.98)
Trimethoprim/Sulfamethoxazole (SXT)	14 (21.21)	14 (21.21)	73 (27.76)	148 (56.27)
Amikacin (AK)	-	-	38 (14.45)	27 (10.27)
Tetracycline (TE)	16 (24.24)	2 (3.03)	37 (14.07)	125 (47.53)
Cephalothin (KF)	-	-	18 (6.84)	47 (17.87)
Cefotaxime (CTX)	0	2 (3.03)	8 (3.04)	14 (5.32)
Gentamicin (CN)	23(34.85)	5 (7.58)	83 (31.56)	114 (43.35)

The present study provides a critical snapshot of the antimicrobial resistance is a problem in our city and as well in other area. A total of 6063 of UTI suspected cases were included in this study. Urine specimens from females 3294 (54%) were higher than those from males 2738 (45.39%) as shown in table 1. This agree with other studies done that showed that urinary tract infections are more common in females than males (Shaban B *et al* 2007, Mohammed K *et al* 2017). This could be explained by the fact that the female urethra appears to be less effective in preventing entry of bacteria, close proximity of the urethral opening to the anus, shorter urethra, sexual intercourse, and incontinence (Ochei *et al*., 2007). This study also showed that, Gram negative bacteria were more common isolated than Gram positive bacteria, counted for 1034 (81.80%) and 230 (18.19 %) respectively out of the total isolated bacterial pathogens 1264, table (3). This was similar to other studies results (Mohammed k *et al*., 2017, Johnson et al., 1995). This finding suggesting intestine as the source infection. Enteric bacteria are members of the family Enterobacteriaceae include *Escherichia coli* from urinary tract infections (UTI) cases and other enteric bacteria, Klebsiella, *Enterobacter*, and *Proteus* species. Regarding to the bacterial species, this study showed that, the total of 1267 bacterial pathogens were isolated belong to eight species were as the following; among Gram negative bacteria which are members of the family Enterobacteriaceae include, *Escherichia coli* as the most common isolated pathogen counted for (624, 49.63%), followed by *Klebsiella species* counted for (213, 16.85%), *Proteus* species counted for (140, 11.07%), and *Pseudomonas* species were less common counted for (57, 4.50 %). On the other hand, among gram positive pathogens, *Staphylococcus aureus* was the most common, counted for (187, 14.79%) followed by *Staphylococcus epidermidis* was (21, 1.66%), while Streptococcal and Enterococcal species were less common, counted only for (7, 0.55%) and (15, 1.18%) respectively as shown in table (5). The same pathogenic bacterial species isolated in this study were reported in other studies (Bean *et al*., 2008, Tambekar *et al*., 2006, Johnson et al., 1995). Among family Enterobacteriaceae *Escherichia coli* was the most common isolated pathogen 624 (49.63%), followed by *Klebsiella species* 213, (16.85%) and *Proteus* species 140 (11.07%), we well collectively indicated them as Gram negative pathogens and *Staphylococcus aureus* as the most common 187 (14.79%) followed by *Staphylococcus epidermidis* 21 (1.66%), we well collectively indicated them as Gram negative pathogens. In this review study, the data extracted from records of the four years, showed increases in bacterial uropathogens resistance to the most commonly consumed antibiotics specially among Gram negative pathogens. Within this study, data on resistance rates in Gram negative uropathogens collected from 2021 – 2024 reveal year on year increases in resistance to Co-trimoxazole, Gentamicin, Tetracycline, Cephalosporins (Cefoxitin and Ceftazidime), ciprofloxacin, Augmentin, Nalidixic acid and Nitrofurantoin and lastly Ampicillin as shown in the antimicrobial sensitivity result tables the same is showed in other study (Bean *et al*., 2008, Tambekar et al., 2006, Chander and Singla., 2007). Resistance of these agents commonly used as empirical oral treatments for UTI was very

high, concluded in limitation in their use, let some of them as do not be the drugs of choice to combat pathogenic bacteria isolated from UTI cases in the future. On the hand, Some of these antimicrobial agents still showing efficacy against some of the mentioned above in particularly Nitrofurantoin, Ciprofloxacin, Co-trimoxazole and Augmentin this had reported in other studies as well as some strains still susceptible (Tambekar *et al*., 2006, Chander and Singla., 2007). Within this study, the antimicrobial resistance rate in case of Gram positive uropathogens, the situation is more worsen. Where obtained data on the resistance rates in Gram positive uropathogens from 2021 – 2024 is very high compared with Gram negative uropathogens to Co-trimoxazole, Tetracycline, Ceftazidime, Augmentin, Nalidixic acid, Ampicillin, but except for Nitrofurantoin, Ciprofloxacin and Cefoxitin that still have moderate activity against Gram positive uropathogens as shown in the antimicrobial sensitivity result tables the same is showed in other study (Bean *et al*., 2008, Tambekar *et al*., 2006, Chander and Singla., 2007). Within the above context, and in the manner of our citation, although UTI is a disease of urinary system, someone have urinary tract infection caused by Gram negative pathogenic bacteria rather than Gram negative. Fortunately, urinary tract infection more common caused by Gram negative pathogens rather than Gram positive pathogens. For both Gram negative and Gram positive uropathogens, effect of different antibiotics was reported, maximal effect showed by Nitrofurantoin, Ciprofloxacin, Cefoxitin, Augmentin, Co-trimoxazole. Contrastingly, minimal effect showed by Nalidixic acid and Ampicillin. In conclusion, unsuitable medication prior to urine culturing causes to increase prevalence of gram positive bacteria as much as gram negatives and developing multidrug resistance.

CONCLUSION

This study demonstrates a high prevalence of antimicrobial resistance (AMR) among uropathogens isolated at our center, with a notable predominance of infections in females (54.60%). Gram-negative bacteria, led by *Escherichia coli* (49.36%) and *Klebsiella* spp. (16.85%), remain the primary etiological agents of UTIs in both inpatient and community settings. The findings reveal a disturbing temporal shift in susceptibility patterns between 2021 and 2024; while Nitrofurantoin and Ciprofloxacin initially showed high efficacy, the emergence of significant resistance against commonly prescribed agents like Ampicillin and Nalidixic acid has limited the options for empirical therapy. The data suggest that although Nitrofurantoin and Augmentin still maintain relatively high sensitivity rates for certain isolates, the overall trend toward multidrug resistance (MDR)—particularly in Gram-positive pathogens—is worsening. These results provide actionable insights for clinicians in the region, emphasizing that the era of "one-size-fits-all" empirical treatment is fading. The high burden of resistance strongly advocates for a mandatory policy shift toward routine urine culture and Antibiotic Susceptibility Testing (AST) to guide definitive therapy and prevent treatment failure.

Ultimately, these findings sound an alarm for the urgent implementation of robust antibiotic

stewardship programs and continuous local surveillance systems to monitor the evolving landscape of AMR. Public health initiatives focused on educating healthcare providers and the public on the rational use of antibiotics—and the dangers of self-medication prior to culturing—are paramount to curbing the spread of these resistant uropathogens and preserving the efficacy of our remaining antimicrobial arsenal.

ACKNOWLEDGEMENT

The authors would like to thank everyone share in this study and help as.

ETHICS

The Research Ethics committee (REC), University of Tobruk (UOT) reviewed discussed your application documents to conduct a study entitled:

I (Prevalence and Antimicrobial Resistance Patterns of Uropathogenic Bacteria: A 4-Year Study at Tobruk Medical Centre, Libya)

In REC meeting we approved your request to conduct the study its present form

The REC expects to be informed about any changes in your study protocol during conduct of the study.

This letter constitutes ethical approval only and you should seek Consent from the Department separately.

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اتجاهات انتشار مسببات الأمراض البولية ومقاومة مضادات الميكروبات في شرق ليبيا على مدى أربع سنوات

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الملخص

تُعدّ التهابات المسالك البولية من أكثر أنواع العدوى البكتيرية شيوعًا، وقد باتت مقاومة المضادات الحيوية المتزايدة تحديًا كبيرًا أمام العلاج الفعال. هدفت هذه الدراسة إلى تقييم مدى انتشار مسببات التهابات المسالك البولية وأنماط حساسيتها للمضادات الحيوية في مركز طبرق الطبي، ليبيا، على مدى أربع سنوات. أُجري تحليل استرجاعي على 6032 عينة بول جُمعت بين يناير 2021 وديسمبر 2024. حُددت العزلات البكتيرية باستخدام الطرق الميكروبيولوجية القياسية، وأُجري اختبار حساسية المضادات الحيوية باستخدام طريقة كيربي-باور لنشر الأقراص وفقًا لإرشادات معهد المعايير السريرية والمخبرية (CLSI). من بين 6032 عينة، أظهرت 1264 عينة (20.95%) نموًا بكتيريًا ملحوظًا. سادت البكتيريا سالبة الغرام (81.8%)، وكانت الإشريكية القولونية (49.36%) أكثر العزلات شيوعًا، تليها أنواع الكلبسيلة. (16.85%) والمكورات العنقودية الذهبية (14.79%). أظهر النيتروفورانتوين أعلى فعالية إجمالية ضد معظم مسببات الأمراض البولية، بينما ازدادت مقاومة العديد من المضادات الحيوية الشائعة الاستخدام خلال فترة الدراسة، مما يشير إلى ظهور اتجاه جديد لمقاومة الأدوية المتعددة. أظهرت مسببات الأمراض البولية المعزولة في مركز طبرق الطبي مقاومة كبيرة للمضادات الحيوية، مما يسلط الضوء على الحاجة إلى إجراء اختبارات حساسية روتينية تعتمد على الزرع، ومراقبة محلية مستمرة لمقاومة المضادات الحيوية، وتعزيز إدارة المضادات الحيوية لتحسين استراتيجيات العلاج التجريبي.

الكلمات المفتاحية: عدوى المسالك البولية (UTIs)، مقاومة مضادات الميكروبات، مسببات الأمراض البولية، العزلات البكتيرية، ليبيا.