Electronic Journal of University of Aden for Basic and Applied Sciences
EJUA-BA Vol. 3 No. 3 (2022)
https://doi.org/10.47372/ejua-ba.2022.3.182
ISSN: 2708-0684

RESEARCH ARTICLE

ISOLATION AND ANTIMICROBIAL SUSCEPTIBILITY PROFILES OF MICROORGANISMS CAUSING URINARY TRACT INFECTION AMONG PATIENTS IN ADEN CITY, YEMEN

Khaled N. Q. Salem[1,*], Alaa A. M.[1], Amal K. A.[1], Amira Q. M.[1], Fatima A. A.[1], Kholood W. A.[1], Marwa N. M.[1], Rasha H. A.[1] and Shifa S. M.[1]

[1] *Dept. of Biology, Faculty of Science, University of Aden, Yemen*

***Corresponding author: Khaled N. Q. S.; E-mail: mohamedkhaled73388@gmail.com**

Received: 05 August 2022 / Accepted: 20 September 2022 / Published online: 30 September 2022

Abstract

Urinary tract infection is an infection that usually affects all people around the world, regardless of gender and ages. Therefore, the present study aimed to isolate microorganisms causing urinary tract infection and their antimicrobial susceptibility profiles among patients attending some private hospitals in Aden city, Yemen.

A total of 78 specimens of midstream urinary were collected from patients presenting in some private hospitals and centers located in Aden - Yemen, during the period from January to August 2021. Urine samples were examined macroscopically and microscopically. Also, the samples were cultured in different media and then incubated aerobically for 18-24 h at 37°C. The bacteria were isolated and diagnosed, and then the bacterial isolates were examined and their sensitivity to antibiotics, using the disc diffusion method (Kirby-Bauer).

Of the 78 samples, 57 (73.08%) were positive for the growth of pathogenic bacteria, 3 (3.85%) fungi, while 3 (3.85%) were negative and 15 samples were discarded for incomplete data. A higher rate of isolates was obtained from negative 33 (55%) compared to positive bacteria 24 (40%). The of infection in females was 48 (55%), while the number of males was 12 (20%). The highest infection recorded was *Streptococcus agalactiae* 12/57 (21%), followed by *Pseudomonas aeruginosa* 9 (15.7%), then *Enterococcus faecalis*, *Enterobacter aerogenes* and *Escherichia coli* each 6 (10.5%). The highest sensitivity of 94.7% was recorded by the antibiotics levofloxacin and ciprofloxacin. But the isolated Gram-negative bacteria showed a sensitivity of 100%. Gram-negative bacteria showed moderate sensitivity against tetracycline 58%, gentamicin 42% and ceftriaxone 45.5%. While lower sensitivity rates were observed for Co-Trimoxazole 31.6%, Cefotaxime 15.8%, and Ampicillin/Sulbactam 15.8%. Cephalexin, linezolid and cloxacillin have demonstrated complete resistance to the antibiotics used. There is a high prevalence of bacterial UTIs among women. Levofloxacin is the most effective antibiotic in treating UTIs, followed by amikacin, ofloxacin and ciprofloxacin. Ampicillin / Sulbactam, Co-trimoxazole, Cefotaxime, Tazobactam / Pipracillin. It is considered the most resistant antibiotic of bacteria isolated from urinary tract infection.

The results confirmed the resistance of the isolated urinary tract bacteria to some of the antibiotics used in our study. Accordingly, we recommend our doctors to take into consideration the developments in the use of antibiotics and resistance by bacteria.

Keywords: Streptococcus agalactiae, Pseudomonas aeruginosa, Urinary tract infection.

Introduction

Microorganisms cause urinary tract infection (UTI) is a common health problem throughout the world. UTI is the most common bacterial infections and account for a significant part of the workload in clinical microbiology laboratories [1]. About 150 million people are diagnosed with UTI each year in worldwide, costing the global economy in excess of 6 billion United States dollars [2].

UTI is defined also as the presence of both significant bacteriuria (105 colony forming unit (cfu/ml) and urinary symptoms [3]. UTI is an extremely common clinical problem which may involve urethra, bladder, uterus and Kidney. Most UTI are caused by bacteria that can live in the digestive tract, the vagina or around the urethra. Infection occurs when bacteria enter the normally sterile urinary system and multiply there [4].

UTI are classified as uncomplicated or complicated [5]. Uncomplicated UTI are subdivided into cystitis and pyelonephritis. Patients with cystitis are presented with dysuria, frequency of micturition, suprapubic pain and may be hematuria [6]. While patients with pyelonephritis are presented with fever, chills, nausea, vomiting, in addition to the other severe symptoms [7]. Complicated UTI occur when there is abnormality in the urinary system or host immunity is suppressed. These patients are mainly predisposed to repeated UTI, renal failure, urea sepsis and death [6].

UTI occurs in all populations and ages [8]. UTI occur in women more commonly than men, this regard to several clinical factors such as, malnutrition factors, hormonal effects and anatomic differences, poor hygiene, low socioeconomic status are associated with UTI and these factors are rife in rural settings [9].

Majority of UTI are ascending infection and begin as cystitis, which results from bacteria entering the bladder through the urethra. If left untreated, these bacteria can spread to kidney causing pyelonephritis, which can result in renal damage. In severe cases, the bacteria can breach the epithelial and endothelial barriers in kidney and invade the bloodstream, leading to bacteremia and systemic sepsis [10].

In Yemen, the resistance to antibiotics becomes more complicated resulting from the availability of antibiotics as over-the-counter-drugs, excess uses, and misuses of antibiotics [11, 12, 13, 14]. Few studies that focused on the surveillance of antibiotic drugs resistance, non-evidence base prescriptions and unsatisfactory data is existed to measure the problem in Yemen [15, 16, 17].

Therefore, the present study aimed to isolate microorganisms causing urinary tract infection ant their antimicrobial susceptibility profiles among patients attending some private hospitals in Aden city, Yemen.

Materials and Methods.

Study area and period

The present study was conducted at some private hospitals including Al-Buraihy Group International Hospital, Shifa Medical center, AL Madinah Medical Center, and Babel Model Hospital which located in Aden, Yemen during the period of January to August 2021.

Collection of urine samples

About 78 samples of midstream urine was collected from infected UTI patients into a 10-15 mL calibrated sterile screw-capped universal container which was initially distributed to the patients as has been described by [18]. Dysuria is central in the diagnosis of UTI; other symptoms may be variably present, infections attending to different hospitals in Aden City. The specimen was appropriately labeled, transported to the laboratory of Faculty of Science, University of Aden, and analyzed within 2 hours after obtaining.

Macroscopicaly examination

Urine samples were examined macroscopically for color, its smell, foam and turbidity; and also measurements of its pH, relative specific gravity and osmolality. Urine specimens whose colors showed amber, pale and deep yellow but clear were regarded as normal, while specimens that showed amber to deep yellow but cloudy, colorless and red/blood stained were regarded as abnormal [19]. Urine dipstick test as rapid detectors of bacteriuria and UTI was performed according to [20].

Microscopicaly examination:

Urine samples were centrifuged at 2000g for 5 minutes. After centrifugation, the supernatant was discarded and a drop or two of the sediment placed on the grease free slide, cover slip applied and examined under the microscope using the high-power field. Reporting system for microscopic identification is at high magnification for pus cells, red blood cells, epithelial cells, casts, crystals, and yeast cells as described by [21].

Isolation and Identification of bacteria

Using calibrated wire loop samples were inoculated in to different medium such as (Cysteine Lactose Electrolyte Deficient (CLED), MacConkey agar, Nutrient agar, DNAse agar, Mueller Hinton agar, Nutrient broth, Triple sugar iron agar, Urea agar, Simmon's citrate agar, Mannitol salt agar, Kligler iron agar, Eosine methylene blue agar). After overnight incubation at 37°C for 24–48 hours colonies were counted to check significant growth. Colony counts yielding bacterial growth of 105/ml of urine were regarded as significant for bacteriuria. The identification of isolated bacteria was primarily performed by colony morphology characterization, Gram staining, capsule formation, and selective media.

Also, biochemical reactions such as Catalase test, Coagulase test, Urease test, Triple sugar iron agar Indole, Methyl red, Voges Proskauer, and Citrate utilization was done according to Bergey's manual of determinative bacteriology [22, 23].

Isolation and Identification of Candida sp.

The isolated Candida sp. was cultured on the surface of Sabouraud Dextrose Agar (SDA) with chloramphenicol (250mg/L). The plates were incubated for 48 h at 37°C. The morphological features for the colony were studied and confirmed by detecting the budding characterization with pseudo-hyphae [24].

The identification of Candida species was preformed depending on morphological characterizations on a culture medium, formation of germ tube, and assimilation of carbohydrate test [25].

Antimicrobial susceptibility testing

The antimicrobial susceptibility testing was done on Mueller-Hinton agar (HI Media Pvt. Ltd., India) using disk diffusion (Kirby Bauer's) technique. This method was done according to Clinical and Laboratory Standards Institute (CLSI) guidelines to determine susceptibility of UTI agents [26].

About three to four well isolated colonies were emulsified in 3ml of sterile physiological saline; turbidity of the inoculum was compared with 0.5 McFarland standard and then swabbed on the surface of Muller Hinton Agar plates with sterile sticks. The antibiotics used in the study were belonging to four different groups of antibiotics: ß-lactam-ß-lactamase-inhibitor (AMC, AML, and PRL), 5-fluoroquinolons (NOR, OF, and CP), Aminoglycosides (GM, and AK), and Cephalosporins (CTX, and CAZ). The UTI of Gram-negative and gram positive were distributed into different antibiotypes. Multidisc for gram positive isolates: Ampicillin/Sulbactam (AS; 20mcg), Co-Trimoxazole (BA; 25mcg), Cephalexin (PR; 30mcg), Tetracycline (TE; 30mcg), Cefotaxime (CF; 30mcg), Ciprofloxacin (CP; 5mcg), Levofloxacin (LE; 5mcg), Linezolid (LZ; 30mcg), Cloxacillin (CX; 5mcg), Roxithromycin (RF; 15mcg), Lincomycin (LM; 2mcg), Gentamicin (GM; 10 mcg). Multidisc for gram negative isolates: Ampicillin/Sulbactam (AS; 20mcg), Co-Trimoxazole (BA; 25mcg), Cefotaxime (CF; 30mcg), Tazobactam/ Piperacillin (TZP; 110 mcg), Chloramphenicol (CH; 30mcg), Ciprofloxacin (CP; 5mcg), Ceftriaxone (CR; 30mcg), Tetracycline (TE; 30mcg), Ofloxacin (OF; 5mcg), Levofloxacin (LE; 5mcg), Gentamicin (GM; 10 mcg), Amikacin (AK; 30 mcg), (HI Media Pvt. Ltd., India) [27].

Antimicrobial susceptibility testing of Candida sp., was done on Mueller-Hinton agar (HI Media Pvt. Ltd., India) using disk diffusion (Kirby Bauer's) technique. Candida sp., were cultivated on Mueller–Hinton Agar with 2% Glucose and 0.5 µg/mL Methylene Blue.

Results

Of 78 samples, 57/78 (73.08%) were positive for growth of pathogenic bacteria and fungi 3 (3.85%) while 3/76 (3.85%) were negative (Fig. 1). Five teen /78 samples were ignored because data were not completed.

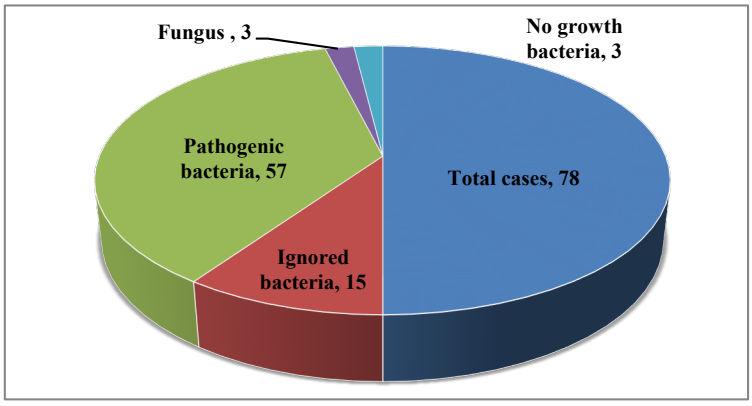

Fig 1: Urinary tract infections (UTI) distribution of pathogenic and non-uropathogenic bacteria.

Macroscopic examination:

Out of the 60 (except Candida case), samples examined, 57 (95%) had positive urine cultures with pathogenic bacteria. The urine colors observed in this study ranged from pale yellow, colorless to red (Tab. 1). The higher percentage 39(65 %) of urine samples were within the normal urine colors, while 21 (35%) had abnormal urine colors of all the samples. A 21 (35%) percentage of samples whose urine colour abnormal had positive UTI culture.

Table 1: Urine color tests in diagnosis UTI.

Urine color	UTI (%)		Total
	Positive	Negative	
Normal	39 (65%)	0	39 (65%)
Abnormal	21 (35%)	0	21 (35%)
Total	**60 (100%)**	**0**	**60 (100%)**

Clinical analysis of urine components:

The study shown an increase in the specific gravity 42 (73.68%). Bilirubin 9 (15.79 %). This study showed the presence of nitrite 9 (15.79 %). The ph value was ranging from 5 to 8.5; Alk.6 (10.53%), Neut. 6 (10.53%) and Acids 45 (78.95 %). Three sample (5.26%), show presence blood (RBC). And some samples show presence of protein 12 (20%), in normal situation. Other components showed normal value such as Glucose and Ketones, test strip results on (Tab. 2).

Table 2: A urine dipstick or test strip results

Chemical Propertied In Urine		Cases N=60
Nitrite		9 (15.79 %)
Specific Gravity		42 (73.68 %)
Protein		12 (21.05 %)
PH	Alk.	6 (10.53%)
	Neut.	6(10.53%)
	Acids	45 (78.95%)
Bilirubin		6 (10.53%)
Urobilinogen		3 (5.26%)
Blood		3 (5.26%)
Ketones		0
Glucose		0

Microscopic characteristics

The percentage of observed microscopically include epithelial cells, bacteria cells, crystals, yeast cells, pus cells and RBC (Tab. 3). The epithelial cells observed in 24 cases (40%), bacterial cells, pus cells and crystals all showed 9 (15%). The study showed 3 (5%) urine specimens which did not show any microscopic feature.

Table 3: Microscopic examination of UTI.

Microscopic results	Urine culture n=60	
	Positive (%)	Negative (%)
Bacterial cells	9 (15%)	0
Epithelial cells	24 (40%)	0
Yeast cells	3 (5%)	0
Pus cells	9 (15%)	0
RBC	6 (10%)	0
Crystals	9 (15%)	0
Total	**60 (100%)**	**0**

Among the 60 (100%) UTI isolates, 24 (40%) were Gram-positive, 33 (55%) were Gram-negative and 3 (5%) Candida spp. (Tab. 4). There were 48 (80%) females and 12 (20%) males in patients with urine positive culture.

Table 4: Frequency of isolated microorganisms according to gender.

Isolated bacteria	No (%)	Female(%)	Male (%)
Gram-negative	33 (55%)	24 (40%)	9 (15%)
Gram-positive	24 (40%)	21 (35%)	3 (5%)
Fungi	3 (5%)	3 (5%)	-
Total	**60 (100%)**	**48 (80%)**	**12 (20%)**

Frequency of isolated bacteria

Table 5 shows the frequency of isolated bacterial species that showed that were *Strep. agalactiae* with 12/57(21%), followed *P. aeruginosa* 9 (15.7%), *E. faecalis* 6 (10.5%), *E. aerogenes* 6 (10.5%), *E. coli* 9 (15.8%), *Staph. saprophyticus* 3 (5.3%), *P. mirabilis* 3(5.3 %), *Staph. epidermidis* 3(5.3 %), *K. pneumoniae* 3 (5.3%) and *K. oxytoca* 3(5.3%).

Table 5: Frequency of bacterial species isolated from urine specimens.

Bacteria	Frequency	Rate (%)
Streptococcus agalactiae	12	20
Pseudomonas aeruginosa	9	15
Enterococcus faecalis	6	10
Enterobacter aerogenes	6	10
Escherichia coli	6	10
Staphylococcus saprophyticus	3	5
Proteus mirabilis	3	5
Proteus vulgaris	3	5
Staphylococcus epidermidis	3	5
Klebsiella pneumoniae	3	5
Klebsiella oxytoca	3	5
Candida spp.	3	5
Total	**60**	**100**

Among males, 12/60 (20%) UTI cases were found (Tab. 6). of *Strepto. agalactiae* (6 female group *P. aeruginosa*, 6 male and female *E. faecalis*, 6 females *E. aerogenes*, 3 female *Staph. saprophyticus*, 3female *Staph. epidermidis*, 3 female *P. mirabilis*, 3 female *K. oxytoca* and 3 male *K. pneumoniae*).

Table 6: Frequency of isolated microorganisms of UTI in relation to gender.

Type of isolated	Male No. (%)	Female No. (%)	Total No. (%)
Gram positive bacteria			
S. agalactiae	3	9	12 (20%)
E. aerogenes	0	6	6 (10%)
Staph. saprophyticus	0	3	3(5%)
Staph. epidermidis	0	3	3 (5%)
Total	3	21	24
Gram negative bacteria			
P. mirabilis	0	3	3 (5%)
P. vulgaris	0	3	3 (5%)
K. pneumonia	3	0	3 (5%)
K. oxytoca	0	3	3 (5%)
E. coli	0	6	6 (10%)
P. aeruginosa	3	3	9 (15%)
Enterococcus faecalis	3	3	6 (10%)
Total	**9**	**21**	**30**
***Candida* spp.,**			
***Candida* spp.**	0	3	3 (5%)
Total	0	3	3

Bacterial and fungal biochemical test:

Using a loop of well-mixed un-centrifuged urine was inoculated on blood and MacConkey agar. Then, bacterial colony **Table 7** was sub-cultured onto the other mentioned above media, were inoculated on biochemical tests. The carbohydrate assimilation tests for *C. albicans* are presented in table 7. It shows that the test was positive for Xylose, Sucrose and Glucose.

Table 7: Biochemical test of bacteria isolated from urine samples:

Test / Type of bacteria	Gram Staining	Capsule	DNase	Urease test	Oxidase test	Motility test	Methyl red	Voges Proskauer	Hemolysis	Catalase test	Simmons citrate test	Glucose	Lactose	Sucrose	Fructose	Xylose	Mannitol
P. aeruginosa	-	-		-	+	+	-	-	-	+	+	-	-	-	+	-	+
S. agalactiae	+	+	ND	-	-	-	-	-	+	-	ND	+	+	+	+	-	-
E. faecalis	+	ND	-	-	-	-	ND	+	+	-	-	+	+	+	+	-	+
P. mirabilis	-	+	-	+	-	+	+	-	ND	+	+	+	+	-	ND	+	-
P. vulgaris	-	-		+	-	+	+	-	-	+	-	+	-	-	ND	ND	-
E. coli	-	+	-	-	-	+	+	-	-	+	-	+	+	-	-	+	+
S. saprophyticus	+	+	-	+	-	-	-	-	-	+	-	+	+	+	+	+	+
K. pneumoniae	-	+	-	+	-	-	-	+	ND	+	+	+	+	+	-	+	+
E. aerogenes	-	+	-	-	-	+	-	+		+	+	+	+	+	+	+	+
S. epidermidis	+	+	-	+	-	-	-	+	-	+	-	+	+	+	+	-	-
k. oxytocin	-	+	-	+	-	-	-	+	-	+	+	+	+	+	ND	+	+
Candida albicans	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	+	-	+	-	+	-

Fungus isolated from UT infection:

Among 60 UTI patients tested 5% three case positive for fungus infection, in this study period the patient was woman, *Candida albicans* was responsible for 5% of UTI. The same case was growth on blood agar. Symptoms such as fever, dysuria, and flank pain was absent in these patients.

Antibiotic susceptibility pattern of UTI isolates:

The isolated uropathogens were high sensitive to the various antibiotics. Among the isolated pathogens showed the highest degree of sensitivity 94.7% towards Levofloxacin and Ciprofloxacin, but showed 100% sensitivity for gram negative. Followed by Amikacin, Ofloxacin and Chloramphenicol which showed 100%, 91%, 81.8% sensitivity for gram negative isolates. Low

sensitivity rates were observed to Tetracycline 58%, Gentamicin 42% and Ceftriaxone 45,5% For gram negative. While low sensitivity rates were observed to Co-Trimoxazole 31.6%, Cefotaxime 15.8%, Ampicillin /Sulbactam 15.8%, Roxithromycin, and Lincomycin which showed 25%, 12.5% sensitivity. For gram positive, Tazobactam/Piperacillin 9.1% for gram negative however the Cephalexin, Linezolid, Cloxacillin they showed complete resistance **table 8**.

Table 8: Antibiotic sensitivity test Kirby-Bauer method. (-) Resistance, (+) Low sensitive, (++) High sensitive.

Bacteria		Antibiotic																
		AS	BA	PR	TE	CF	CP	LE	LZ	OF	CX	RF	LM	GM	TZP	CH	CR	AK
P. aeruginosa	R/S	-	-		+	+	++	++		+				+	-	+	+	++
E. faecalis	R/S	-	+	-	+	-	++	++	-		-	++	+	+				
P. mirabilis	R/S	++	++		++	-	++	++		++				++	-	++	-	++
P. vulgaris	R/S	-	-		++	-	++	++		++				-	-	++	-	++
E. coli	R/S	-	-		-	-	++	++		++				++	-	+		++
K. pneumoniae	R/S	-	++		++	-	++	++		++				++	-	++	-	++
k. oxytocin	R/S	-	-		-	-	++	++		++				-	-	++	-	++
S. agalactiae	R/S	-	+	-	++	+	++	++	-		-	+	-	+				
E. aerogenes	R/S	+	+		++	+	++	++		++				++	+	++	++	++
S. saprophyticus	R/S	-	-	-	-	-	++	++	-		-	-	-	-				
S. epidermidis	R/S	-	++	-	-	-	++	++	-		-	-	-	-				

Pseudomonas aeruginosa showed the highest rates of sensitivity to Amikacin, levofloxacin and Ciprofloxacin 100%, and the low sensitivity to Gentamicin and Cefotaxime (33.33%), the Ampicillin / Sulbactam, Co-Trimoxazole and TZP they showed complete resistance. *Escherichia coli* showed the highest rates of sensitivity to Ofloxacin, Gentamicin, Amikacin, Levofloxacin and Ciprofloxacin 100%, the Ampicillin/Sulbactam, Co-Trimoxazole, Cefotaxime, TZP and Tetracycline they showed complete resistance. *Enterococcus faecalis* showed high sensitivity for Ciprofloxacin, Levofloxacin and Roxithromycin 100%, and showed complete resistance to Ampicillin/ Sulbactam, Cephalexin, Cefotaxime, Linezolid and Cloxacillin. *Proteus mirabilis* showed sensitivity to Ampicillin/ Sulbactam, Co-Trimoxazole, Chloramphenicol, Ciprofloxacin, Tetracycline, Ofloxacin, Gentamicin, Amikacin and levofloxacin and showed resistance to Cefotaxime, Tazobactam/ Piperacillin and Ceftriaxone. *Proteus vulgaris* showed sensitivity to Chloramphenicol, Ciprofloxacin, Tetracycline, Ofloxacin, Amikacin and levofloxacin and showed resistance to Ampicillin/ Sulbactam, Co-Trimoxazole, Cefotaxime, Tazobactam/Piperacillin, Gentamicin and Ceftriaxone. *Klebsiella pneumonia* showed sensitivity to Co-Trimoxazole, Chloramphenicol, Ciprofloxacin, Tetracycline, Ofloxacin, Gentamicin, Amikacin and levofloxacin and showed resistance Ampicillin/ Sulbactam, Cefotaxime, Tazobactam / Piperacillin, and Ceftriaxone. *Klebsiella oxytoca* showed sensitivity to Ciprofloxacin, Chloramphenicol, Ofloxacin, Amikacin and levofloxacin and showed resistance to Ampicillin/Sulbactam, Co-Trimoxazole, Cefotaxime Tazobactam/Piperacillin, Ceftriaxone, Tetracycline and Gentamicin.

According to UTI bacterial species isolated, *Strepto. agalactiae* as the predominant cause of UTI showed the highest rates of sensitivity to Tetracycline, Ciprofloxacin and Levofloxacin 75%, the Ampicillin /Sulbactam, Cephalexin, Linezolid, Cloxacillin and Lincomycin the showed complete resistance. *Enterobacter aerogenes* showed high sensitivity to Chloramphenicol, Ciprofloxacin, Ceftriaxone, Tetracycline, Ofloxacin, Gentamicin, Amikacin and levofloxacin 100% and followed by Ampicillin/ Sulbactam, Co- Trimoxazole, Cefotaxime and Tazobactam /Piperacillin 50%. *Staph. saprophyticus* showed sensitivity to Ciprofloxacin and Levofloxacin and resistance to Ampicillin/Sulbactam, Co-Trimoxazole, Cephalexin, Tetracycline, Cefotaxime, Cloxacillin, Roxithromycin, Lincomycin, Gentamicin and Linezolid. *Staphylococcus epidermidis* showed sensitivity to Ciprofloxacin, Levofloxacin and Co Trimoxazole, and showed resistance to Ampicillin/Sulbactam, Cephalexin, Tetracycline, Cefotaxime, Cloxacillin, Roxithromycin, Lincomycin, Gentamicin and Linezolid.

Antifungal susceptibility pattern

Treatment was often based on a single culture without documenting the site of infection inside the urinary tract and without a follow-up urine culture performed. Fluconazole was the most frequent antifungal used followed by Voriconazole. The other antifungal antibiotic were resistance to the, Nystatin, Clotrimazole, Miconazole and Metronidazole.

Table 9: Antifungal susceptibility pattern of *C. albicans* isolates:

Fungi	NS	VRC	FLC	CC	MI0	MIC
Candida spp.	R	S	S+	R	R	R

Discussion

Health care associated infections are the leading cause of morbidity and mortality [28]. The high overall prevalence of UTI in the present study was 73.08%. This is similar to that find in Iraq 70% [29], but UTI was higher than other studies from Indian 49.19% [30], Libya 13.9% [31]. The reason for such variable results may due to the differences in the sample size and number, hospital site and season.

Among the relative prevalence of uropathogens isolated in this study, (55%) belonged to gram negative bacteria, (40%) belonged to gram positive bacteria, while (5%) belonged to fungi. Such findings were nearly come in agreement with result of [32], who found that the percentage of Gram negative bacteria, Gram positive constituted (34.14%), (26%), respectively. The gram negative bacteria were more prevalent (55%) in this study which is in agreement with previous studies [33]. Gram negative bacteria are the dominant bacteria that cause UTI [34]. This could be due to the presence of unique structure in gram negative bacteria (pilus adhesins and capsular polysaccharide) which help these bacteria for attachment to the uroepithelial cells and prevent bacteria from urinary lavage, allowing for multiplication and tissue invasion in invasive infection and pyelonephritis.

In laboratories used fresh, uncentrifuged urine dipstick as specimens. Many urinary pathogens will convert nitrates in the urine to nitrites. As such, the presence of nitrites in the urine is highly suggestive of infection, this study and the other study points to that [35]. Some pathogens do not induce this reaction. The leukocyte esterase, which produced by WBC, its presence in the urine raises the doubt of a UTI, but the test is often positive in the absence of a UTI. However, if this test negative, the chance is low of the patient having a UTI.

More girls (80%), than boys (20%), were having UTI. This is similar to that find in Hawassa, Southern Ethiopia were females are more affected than males 58.5% versus 41.5% [36], the same results were found in Yemen were females are more affected than males 40.3% versus 29% [17]. High prevalence of UTI among female may be due to lack of prostatic fluid, moist urethra or females have wider urethra. Previous researches has shown that female patients have much higher predisposition to UTI than males [37, 38], but this results was different from the study done in Nepal report high percentage of males with UTI 69.3% [39].

The distribution of UTI among patients' age groups, pointing to the higher incidence of UTI was seen in adults and elderly 80%, especially sexually actives, followed by then among children 20%. In contrast to the other research, UTI among elderly, adults and children were 58.7%, 36.2%, and 5.1%, respectively [40]. While, UTI was found in 16.55% of elderly women [41]. The differences results in the type and distribution of uropathogens show a discrepancy from area to another due to many factors as environmental conditions, health practices, patient conditions, personal hygiene, number of patients examined, and laboratory procedures. The possible causes of UTI in elderly may be attributed to many factors including urinary tract anomalies, urinary and fecal incontinence, malnutrition, functional disability, diabetes, problems in the immune system, prostate enlargement in males and post-menopausal hormonal changes in females [41].

The study showed some our isolates have a capsular polysaccharide such as (*K. oxytoca, E. aerogenes* and *Strepto. agalactiae*), this is similar to the find [42], most capsules function in microbial pathogenesis by protecting the microbe against host immune mechanisms, although for some the capsular structures can serve as adhesions.

In the present study, the most prevalent isolated bacterial uropathogens was *Strepto. agalactiae*, with an isolated rate of 20%, this finding is higher than the study of Nadia and Zainb [43], (7.75%). The rarity of UTI by *Strepto. agalactiae* is in contrast to the high frequency with which the organism colonizes the normal urethra, and come opposite with previous studies conducted in *E. coli* which was the most in Nepal 74% [44], Bangladesh 48.39% [45], but higher than our study (10%). The second predominant isolate were *P. aeruginosa* with overall isolated rate of 15%, which is similar with previous study in Rea-Raisin 16% [46]. While previous study done in Iran reported lower percentage of *P. aeruginosa* 4.9% [47], and in Yemen were 3.1% [32].

A study of Aamal [48], found that the percentage *Staphylococci spp.,* of positive culture of urine specimen collected from UTI among pregnant women in Al-Diwaniya city district only about (4.63%) that gave agreement with our result. In contrast, the prevalence of *Staph. saprophyticus* and *Staphy. epidermidis* (5%) in the current study is lower than the 16.8% reported by [49]. The prevalence of *E. aerogenes* was (10%) in this study, this close with the results of [32], whose showed that *E. aerogenes* was 7.8%, while Angoti *et al.,* [37], found that *E. aerogenes* was 29.61%. *Enterococcus faecalis*, 10% isolated which is lower than the findings of [45], (29.11%), and higher than the study of [37], (2.3%). The prevalence of *P. vulgaris* was (5%) in this study, this lower than the study of [39], whose showed that *P. vulgaris* was 17.9%, While the *P. mirabilis* 5.1%, that gave agreement with our study 5%. The prevalence of *k.*

oxytoca and *K. pneumoniae* (5%) in this study, is also comparable with the study reported by Richa *et al.,* [39], which was *K. oxytoca* (7.7%), and *K. pneumoniae* (2.6%). The similarities and differences in the type and distribution of UTI may result from geographical variability, host factors, and practices of people such as healthcare and education, socioeconomic and hygiene standards in different countries.

Regarding the distribution of UTI among patients' age groups, an evidence of higher prevalence of UTI showed in 19-50 years of adults. This finding is similar to study conducted by Seifu *et al.,* [38] and Enayat *et al.,* [49]. Prevalence difference has been also observed among various age groups. This difference suggests that age is one risk factor associated with UTI. The high incidence of UTI amongst the old age group could be due to genito-urinary atrophy and vaginal prolapse after menopause in female which in turn increases the risk of bacteriuria by increasing vaginal pH and decreasing vaginal *Lactobacillus* thereby allowing gram-negative bacteria to grow and act as uropathogens. Because of wide spread of antibiotic, especially in developing countries, the resistance profile of microorganism to antimicrobial agents is increasing frequently Foxman, [50].

This study showed that the highest susceptibility rate (94.7%) for all uropathogens isolates were to Ciprofloxacin. This finding is comparable to other reports but relatively higher than the reported of [39, 51]. Amikacin was highly active (100%) for gram negative, this finding is similar to previous studies in the other countries [31, 37, 52]. However, this sensitive rate to amikacin is higher than 67.2% prevalence reported from South India [53]. Levofloxacin was highly active (100%) too, which contradicted with the study of [54]. The possible explanation for high level susceptible to Levofloxacin, Amikacin and Ciprofloxacin may be due to infrequent prescriptions, also they are not easily accessible. Thus, Levofloxacin, Amikacin and Ciprofloxacin could be considered as alternative options in the treatment of UTI.

The activity of Co-Trimoxazole against Gram negative isolates was (13.6%), this result is come negatively with that shown by Tsegay, [55] in Ethiopia, Co-Trimoxazole was reported to showed 58.4% activity, while Raya, [56], found that 67% of the isolates were resistant, and cefotaxime was active against (15.8%) of isolates. This result agreed with that of Raya, [56], found that 96% of the isolates were resistant, while Mohammed *et al.,* [31] who showed that high sensitivity of isolates to Cefotaxime in UTI. Cefotaxime against *E. coli* isolates was (0%), While Eshetie *et al.,* [57] found that the cefotaxime showed low resistance against 21.4% of the isolates.

Ampicillin /Sulbactam had low activity (15.8%) to Gram negative isolates in this study, this finding is similar to some studies conducted in Yemen showed that Ampicillin was resistance 97% of Gram negative pathogens. Ampicillin/Sulbactam is often used to treat polymicrobial bacterial infections [58, 59, 60]. Its use, as well as the use of other β-lactam–β-lactamase inhibitor antibiotics, will likely increase in hospitals as a result of the high prevalence of antibiotic-resistant organisms. Although ampicillin/Sulbactam has traditionally had good activity against *E. coli* [61, 59].

Gentamicin was active against (42%) of isolates. Gentamicin was active against (42%) of isolates. Gentamicin was active against (42%) of isolates. This result come negative with that of [62] (80.6%), and [32] (50.3%), who reported that the isolates had higher sensitive to Gentamicin. Tetracycline was active against (58%) of isolates, will the study of Kahiry *et al.,* [32] who showed that low sensitivity of isolates to Tetracycline was 19.1% in Yemen, Mohammad, [31] who reported that the resistance to tetracycline was (71%).

Pseudomonas aeruginosa showed the highest rates of sensitivity to amikacin, levofloxacin and Ciprofloxacin 100%, followed by Chloramphenicol, Ceftriaxone, Tetracyclic and Ofloxacin 66.7 %, and the low sensitivity to Gentamicin and Cefotaxime (33.33%). The Ampicillin /Sulbactam, Co-Trimoxazole and Tazobactam / Piperacillin they showed complete resistance, in critical care settings with a high rate of antibiotic use, colonization pressure and non-antibiotic exposures may be the crucial factors for *P. aeruginosa* acquisition, whereas Fluoroquinolones may actually decrease its likelihood. For the acquisition of strains resistant to Piperacillin/Tazobactam, Fluoroquinolones and multiple drugs, exposure to amikacin may be more relevant than previously recognized, Trigueros *et al.,* [63].

There are more than 100 species of Candida (yeast) in nature, but only a few species are recognized causes of disease in humans. *C. albicans* is the most common medically significant Candida species identified [64]. Antifungal drugs are effective in the treatment of *C. albicans*. Fluconazole appeared to be the best drug for the treatment of *C. albicans*. Our results in line with the study of [65] who points to the Azole antifungals group (fluconazole, voriconazole), are recommended as the first-line treatment in all guidelines. imidazoles, triazoles demonstrate greater target specificity, are more resistant to metabolic degradation, and have superior potency [66]. Azoles ordinarily have long half-lives at approximately 30 h, with the exception of voriconazole which has a half-life of 6 h [67].

Conclusion

Of the total 78 patients complains of UTI, the overall rate prevalence of UTI was 73.08%. The specimens diagnosed based on patient's clinical symptoms, presence of leukocytes, and bacteria in the urine. Among the causative agent of UTI Gram negative bacilli bacteria, Gram positive cocci bacteria and fungi wear constituted of (55%), (40%) and (5%), respectively. The predominant uropathogens isolated wear *Strepto. agalactiae* with 20%, followed by *P. aeruginosa*. The prevalence of UTI was high in female than male 80% and 20% respectively and high in age group19_60 years of adults than other age group. The levofloxacin was the most effective antibiotic for treatment of UTI followed by Amikacin and Ofloxacin, Ciprofloxacin. Ampicillin/Sulbactam, Co-trimoxazole, Cefotaxime and Tazobactam/Piperacillin, wear the most antimicrobial agent to which the isolates developed resistance in UTI.

Acknowledgement

All thanks goes to Dr. Walid Mahmoud, Mgr. Issam Mohammed, Mgr. Nohad Fartoot, the director of Shifa Medical Centre Rashad Ahmed Abdullah Almahwari, and all the workers of Shifa Medical Centre, Doctors and laboratories, for helping us to accomplish a safe conduct of data analysis.

References:

[1] A.M. Aboukay, A.M. Albakosh, M.M. Ali, A. Alrtail, M.M. Rzeg," Etiology of Uropathogenic Bacteria in Patients with Urinary Tract Infection. in Zliten, Libya. Journal of Humanities and Applied Science. (29): 15-32. 2016.

[2] R. Ikram, A. Carter, P. Priest, R. Psutka," An outbreak of Multi-drug resistant *Escherichia coli* Urinary tract infection in an elderly population: a case - control study of risk factors. Biomed Central Infectious diseases. 15(224): 1-7. 2015.

[3] O.A. Alawamlh, R. Goueli, R.K. Lee," Lower Urinary Tract Symptoms, Benign Prostatic Hyperplasia, and Urinary Retention. Med. Clin. North. Am. 102(2):301-311. 2017.

[4] M. Grabe, R. Bartoletti, T.E. Bjerklund Johansen, T. Cai, M. Çek, B. Köves, K.G. Naber, R.S. Pickard, P. Tenke, F. Wagenlehner, B. Wullt," Guidelines on Urological Infections. European Association of Urology. Urological Infections - Limited Update March 2015.

[5] S. Antinori, M.D. Pezzani," Uncomplicated and Complicated Urinary Tract Infections in Adults: The Infectious Diseases's Specialist Perspective. In: Tonolini M. (eds) Imaging and Intervention in Urinary Tract Infections and Urosepsis. Springer, Cham. 2018.

[6] D.S. Abd Elmagid, A.M. El-Sabbagh," Heparin-Binding Protein as an Immunological Marker in Children Urinary Tract Infection. Egyptian Journal of Medical Microbiology. 26(3):131-135. 2017.

[7] M.U. Hussein, R.T. Mohsen," Urinary Tract Infection Risk Assessment by Non-Thermal Plasma in Iraqis Patients. Al-Kindy College Med. Journal. 13(1): 86 -91. 2017.

[8] H.W. Edrees, A. A. Anbar," Prevalence and antibacterial susceptibility of bacterial uropathogens isolated from pregnant women in Sana'a, Yemen. PSM Biol Res., 5(4): 157-165. 2020.

[9] B.H. Oladeinde, R. Omoregie, M. Olley, J.A. Anunibe," Urinary tract infection in a rural community of Nigeria. North Am. J. Med. Sci. 3: 75-77. 2011.

[10] Z. Lin, M.T. Zaw," Uropathogenic *Escherichia coli*: A Pathogen Producing Multiple Virulence Factors. Borneo Journal of Medical Sciences. 8:35- 46. 2014.

[11] M.W. Al-Haik, M.A. Al-Haddad, G.A. Al-kaf, H.W. Edrees," Antimicrobial activities for hadhrami honey on growth of some pathogenic bacteria. Universal J Pharm Res., 2(6): 7-12. 2017.

[12] A. M. Halboup, K. H. Alzoubi, G. Q. Othman," Awareness of Bacterial Resistance to Antibiotics among Healthcare Providers in Sana'a City, Yemen. Yemeni Journal for Medical Sciences. 12(1). 2018.

[13] W.H. Edrees," Antibacterial susceptibility and Sider honey activity against isolated bacteria from wound patients attending at Al-Gmohori hospital in Hajja City, Yemen. Al-Razi Univ. J. Med. Sci. 5 (2):1-8. 2021.

[14] F. S. Wafa, B.M. Alshakka, M.I. Ibrahim," Antimicrobial Resistance Profiles for Different Isolates in Aden, Yemen: A Cross-Sectional Study in a Resource-Poor Setting. Bio. Med Research International 2020, Article ID 1810290.

[15] M.F. Alhlale, A. Humaid, A.H. Saleh, K.S. Alsweedi, W.H. Edrees," Effect of most common antibiotics against bacteria isolated from surgical wounds in Aden Governorate hospitals, Yemen. Universal J. Pharm. Res. 5(1): 21-24. 2020.

[16] H.W. Edrees, M. Alshwmi, A.B. Al-Ofairi," Prevalence and antifungal susceptibility of *Candida* species causing vaginitis among pregnant women in Hajjah Governorate, Yemen. Al-Razi Univ. J. Med. Sci. 5;(1): 1-8. 2021.

[17] A.S. Gondos, K.A. Al-Moyed, A.B. Al-Robasi, H.A. Al-Shamahy, N.A. Alyousefi," Urinary Tract Infection among Renal Transplant Recipients in Yemen. PLoS ONE 10(12): e0144266. 2015.

[18] N. J. Amaeze, A. U. Abah, I. N. Okoliegbe," Prevalence and antibiotic susceptibility of uropathogens among patients attending University of Abuja Teaching Hospital, Gwagwalada, Abuja. International Journal of Medicine and Medical Sciences. 5(10): 460-466. 2013.

[19] J. Simerville, W.C. Maxted, J.J. Pahira," Urinalysis: A Comprehensive Review. Am. Fam. Physician. 74(7):1096. 2006.

[20] W.L. Deville, J.C. Yzermans, N.P. van Duijn, P.D. Bezemer, D.A. van der Windt, L.M. Bouter," The urine dipstick test useful to roll out infection. Amela analysis of the accuracy. BMC. Urol., 4: 4. 2004.

[21] A.H. Hantalo, K.H. Taassaw, F.S., Bisetegen, Y.W. Mulate," Isolation and Antibiotic Susceptibility Pattern of Bacterial Uropathogens and Associated Factors Among Adult People Living with HIV/AIDS Attending the HIV Center at Wolaita Sodo University Teaching Referral Hospital, South Ethiopia. HIV/AIDS-Research and Palliative Care. 12:799-808. 2020.

[22] J. Don, R. Noel, T. James, M.G. George," Bergey's manual of systematic bacteriology. Second edition. Michigan State University, East Lansing, USA. 2(B.C). 2004.

[23] R. Bhatia, R. L. Ichhpujani," Essentials of Medical Microbiology, (4th ed.). New Delhi: Jaypee Brother Medical Publishers. pp. 46-47. 2008.

[24] M.T. Hedayati, Z. Taheri, T. Galinimoghadam, S.R. Aghili, J.Y. Cherati, E. Mosayebi," Isolation of Different Species of *Candida* in Patients With Vulvovaginal Candidiasis From Sari, Iran. Jundishapur J. Microbiol. 8(4): e15992. 2015.

[25] T. Matare, P. Nziramasanga, L. Gwanzura, V. Robertson," Experimental Germ Tube Induction in *Candida albicans*: An Evaluation of the Effect of Sodium Bicarbonate on Morphogenesis and Comparison with Pooled Human Serum. Bio. Med. Research International. Article ID 1976273, 5 pages. 2017.

[26] Clinical and laboratory standards institute. Performance standards for antimicrobial susceptibility testing. 12th Informational supplement. CLSI document M100-S12. Pennsylvania, USA. (1): 1. 2002.

[27] B.A. Forbes, D.F. Sahm, A.S. Weissfeld," Bailey and Scott's Diagnostic microbiology, 12th edition, Mosby Elsevier. 842-55. 2007.

[28] M. Medina, E. Castillo-Pino," An introduction to the epidemiology and burden of urinary tract infections. Ther. Adv. Urol. 11: 3–7. 2019.

[29] A.H. Zainab, A.H. Nadia," Isolate and diagnose some types of bacteria from patients with urinary tract and determine their ability to resist antibiotics Life. College of Education for Pure Sciences. 7(1): 107-117. 2017.

[30] T. Shilpi, M.N. Ahmed, S.M. Huq, S.K. Baul, M. Khatun," Isolation of Bacteria Causing Urinary Tract Infections and their Antibiotic Susceptibility Profile at Anwer Khan Modern Medical College Hospital. AKMMC. J. 4(2):23-27. 2013.

[31] M.A. Mohammed, T.M. Alnour, O.M. Shakurfo, M.M. and Aburass," Prevalence and antimicrobial resistance pattern of bacterial strains isolated from patients with urinary tract infection in Messalata Central Hospital, Libya. Asian Pacific Journal of Tropical Medicine. 9(8):771-776. 2016.

[32] W. Kahiry, S. Bakhubaira, A. Abood," Urine culture and sensitivity at ALGamhouria Teaching Hospital. Univ. Aden J. Nat. and appl. Sc. 10(3): 567-574. 2006.

[33] M.S. Rasool, S. Siddiqui, M. Ajaz, S.A." Prevalence and antibiotic resistance profiles of Gram negative bacilli associated with urinary tract infections (UTIs) in Karachi, Pakistan. Pak. J. Pharm. Sci., 32 (6): 2617-2623. 2019.

[34] B. Ayelign, B. Abebe, A. Shibeshi, S. Meshesha, T. Shibabaw, Z. Addis," Bacterial isolates and their antimicrobial susceptibility patterns among pediatric patients with urinary tract infection. Turk. J. Urol. 44(1): 62-9. 2018.

[35] M.U. Hussein, R.T. Mohsen," Urinary Tract Infection Risk Assessment by Non-Thermal Plasma in Iraqis Patients. Al-Kindy College Med. Journal. 13(1): 86 -91. 2017.

[36] N.N. Tessema, M.M. Ali, M.H. Zenebe," Bacterial associated urinary tract infection, risk factors, and drug susceptibility profile among adult people living with HIV at Haswassa University Comprehensive Specialized Hospital, Hawassa, Southern Esthiopia. Scientific Reports. 10:10790. 2020.

[37] G. Angoti, H. Goudarzi, M. Hajizadeh, Z. Tabatabaii," Bacteria isolated from urinary tract infection among patients and determination of the antibiotic susceptibility patterns of the gram negative bacteria in Iran. Novelty in Biomedicine 4 (1):1-4. 2016.

[38] W.D. Seifu, A.D. Gebissa," Prevalence and antibiotic susceptibility of Uropathogens from cases of urinary tract infections (UTI) in Shashemene referral hospital, Ethiopia. BMC Infect. Dis. 18:30. 2018.

[39] C. Richa, C.S. Bhushan, S.P. Kumar, P.N. Dev, P. Nabaraj," Bacteriology of Urinary Tract Infection of Chronic Renal Failure Patients Undergoing for Hemodialysis. J. Microbiol. Exp. 3(3): 00089. DOI: 10.15406/jmen.2016.03.00089. 2016.

[40] E. Magliano, V. Grazioli, L. Deflorio, A.I. Leuci, R. Mattina, P. Romano, C.E. Cocuzza," Gender and Age-Dependent Etiology of Community-Acquired Urinary Tract Infections. 2012:1-6. 2012.

[41] L. Marques, J. Flores, O. Junior, G. Rodrigues, C. Mourão, R. Moreira," Epidemiological and clinical aspects of urinary tract infection in community-dwelling elderly women. The Brazilian Journal of Infectious Diseases. 16(5):436-441. 2012.

[42] G.G. Anderson, C.C. Goller, S. Justice, S.J. Hultgren, P.C. Seed," Polysaccharide Capsule and Sialic Acid-Mediated Regulation Promote Biofilm-Like Intracellular Bacterial Communities during Cystitis. Infection and Immunity. 78(3):963–975. 2010.

[43] A.H. Nadia, A.H. Zainb," Isolate and diagnose some types of bacteria from patients with urinary tract and determine their ability to resist antibiotics Life. human urinary tract. International Journal of Antimicrobial Agents 19:522-538. 2014.

[44] L. Dotevall, P. Maskey, A. Arjyal, S. Poojan," Urinary tract infections – Etiology, antibiotic susceptibility, and treatment in surgical patients in Nepal, Master thesis in Medicine, Programme in Medicine, Gothenburg, Sweden 2014.

[45] S. Mollick, T. Dasgupta, M.J. Hasnain, M. Ahmed," Isolation and Characterization of Pathogens Responsible for Urinary Tract Infection in Bangladesh and Determination of their Antibiotic Susceptibility Pattern. J. App. Pharm. Sci. 6 (04): 072-076. 2016.

[46] A.G. Venier, T. Lavigne, P. Jarno, F. L'heriteau, B. Coignard, A. Savey, A.M. Rogues," Nosocomial urinary tract infection in the intensive care unit: when should *Pseudomonas aeruginosa* be suspected? Experience of the French national surveillance of nosocomial infections in the intensive care unit, Rea-Raisin. Clin. Microbiol Infect. 18: E13–E15. 2012.

[47] H. Vaez, A. Salehi-Abargouei, Z.R. Ghalehnoo, F. Khademi," Multidrug Resistant *Pseudomonas aeruginosa* in Iran: A Systematic Review and Meta-analysis. J. Glob. Infect. Dis. 10(4):212–217. (2018).

[48] G. M. Aamal," Isolation & Identification of aerobic bacteria Causing Urinary Tract Infection in Pregnant Women in Al-Diwaniya city and its sensitivity to some antibiotics. Al-Qadisiyah Journal of pure science. 14(1):1-13. (2009).

[49] K. Enayat, F. Fariba, N. Nikkho Bahram," Asymptomatic Bacteriuria among Pregnant Women Referred to Outpatient Clinics in Sanandaj, Iran. International Braz. J. Urol. 34(6): 699-707. 2008.

[50] B. Foxman," Urinary tract infection syndromes: occurrence, recurrence, bacteriology, risk factors, and disease burden. Infect. Dis. Clin. North Am. 28:1–13. 2014.

[51] R. Ghotasloua, M.R. Sadeghia, M.T. Akhib, A. Hasanib, M. Asgharzadehd," Prevalence and Antimicrobial Susceptibility Patterns of ESBL, AmpC and Carbapenemase-producing Enterobacteriaceae Isolated from Hospitalized Patients in Azerbaijan, Iran. Iranian Journal of Pharmaceutical Research. 17: 79-88. 2018.

[52] M. Rajabnia-Chenari, S. Gooran, F. Fazeli, A. Dashipour," Bacteriology of urinary tract infection of chronic renal failure patients undergoing for hemodialysis. Zahedan J. Res. Med. Sci.14(8):74-76. 2012.

[53] P.S. Kalal, R.P. Patel," Microbiological and Antimicrobial Profile of Urinary Tract Infection in Children from A Teaching Hospital in South India. J. Pediatr. Inf. 11:19-22. 2017.

[54] F. Terahara, H. Nishiura," Fluoroquinolone consumption and *Escherichia coli* resistance in Japan: an ecological study. BMC Public Health. 19 (1):1-8. 2019.

[55] E. Tsegay," Bacterial Profile and Drug Susceptibility Pattern of Urinary tract infection in Pregnant Women Attending Antenatal Care at Mekelle Hospital, Mekelle, Northern Ethiopia. Unpublished Master Dissertation, Addis Ababa University, Addis Ababa, Ethiopia. 2014.

[56] M. H. Raya," Prevalence of Urinary Tract Infection among Children of Primary Schools in Nablus. Thesis from An-Najah National University, Faculty of Graduate Studies. 2009.

[57] S. Eshetie, F. Mekonnen, G. Kumera, F. Tarekegn," Multidrug resistant *Escherichia coli* strains isolated from urine sample, University of Gondar Hospital, Northwest Ethiopia. Journal of Coastal Life Medicine. 4(2): 140-142. 2016.

[58] H.W. Edrees, S.M. Al-Awar," Bacterial contamination of mobile phones of medical laboratory workers at Sana'a city, Yemen and their antimicrobial susceptibility. JPPRes. 8 (6): 591-599. 2020.

[59] F.M. Alhlale, H.A. Saleh, S.K. Alsweedi, H.W. Edrees," The inhibitory effect of *Euphorbia hirta* extracts against some wound bacteria isolated from Yemeni patients. COPS. 3(2): 780-786. 2019.

[60] W.H. Edrees, A.M. Anbar," Prevalence and antibiotic susceptibility of *Streptococcus pyogenes* isolated from schoolchildren in Sana'a City, Yemen. PSM Vet. Res., 6(2): 22-30. 2021.

[61] P. I. Rafailidis, E. N. Ioannidou, M. E. Falagas," Ampicillin/Sulbactam Current Status in Severe Bacterial Infections. Drugs. 67 (13): 1829-1849. 2007.

[62] L. Kareem," Bacterial Causes of Urinary Tract Infection in Human and Sensitivity of Antibiotic in AL-Kut City. Journal of the college of Basic Education. 20 (86):1003-1012. 2014.

[63] N.C. Trigueros, M. Solé, P. Castro, J.L. Torres, C. Hernández, M. Rinaudo, S. Fernández, A. Soriano, J.M. Nicolás, J. Mensa, J. Vila, J.A. Martínez," Acquisition of *Pseudomonas aeruginosa* and its resistance phenotypes in critically ill medical patients: role of colonization pressure and antibiotic exposure. Critical Care. 19:218. 2015.

[64] W.H. Edrees, A.A. Al-Asbahi, W.A. Al-Shehari, E.A. Qasem," Vulvovaginal candidiasis prevalence among pregnant women in different hospitals in Ibb, Yemen. Universal J. Pharm. Res. 5(4):1-5. 2020.

[65] C. Chayachinda, T. Rekhawasin, M. Thamkhantho, P. Aneklap," Acute Vaginal Candidiasis: A review of treatment guidelines and Siriraj experience. Thai Journal of Obstetrics and Gynaecology. 29(6): 306-312. 2021.

[66] K. Shalini, N. Kumar, S. Drabu, P.K. Sharma," Advances in synthetic approach to and antifungal activity of triazoles. Beilstein J. Org. Chem. 7: 668–677. 2011.

[67] E.M. Billaud, R. Guillemain, M. Berge, C. Amrein, S. Lefeuvre, A.L. Louët, V. Boussaud, P. Chevalier," Pharmacological considerations for azole antifungal drug management in cystic fibrosis lung transplant patients. Med. Mycol. 48: 203. 2010.

مقالة بحثية

عزل وتقييم حساسة المضادات الحيوية للكائنات الحية الدقيقة المسببة التهاب المسالك البولية بين المرضى بمدينة عدن، اليمن

خالد ناشر قحطان سالم[1,*]، الاء علي محمد بن عبدة[1]، أمل خالد عبدالملك عبدة[1]، أميرة قائد محمد ابوبكر[1]، فاطمة أحمد علي عمر[1]، خلود وليد أحمد عبدالله[1]، مروى نادر محمود الغفور[1]، رشا حسين علي محسن[1] و شفا شوقي محمد علي[1]

[1] قسم علوم الحياة، كلية العلوم جامعة عدن، اليمن

* الباحث الممثّل: خالد ناشر قحطان سالم؛ البريد الالكتروني: mohamedkhaled73388@gmail.com

استلم في: 05 أغسطس 2022 / قبل في: 20 سبتمبر 2022 / نشر في 30 سبتمبر 2022

المُلخّص

عدوى المسالك البولية هي عدوى تصيب عادة جميع الناس في جميع أنحاء العالم، بغض النظر عن الجنس والأعمار. لذلك هدفت الدراسة الحالية إلى عزل الكائنات الحية الدقيقة المسببة لعدوى المسالك البولية وملامح حساسيتها لمضادات الميكروبات بين المرضى الذين يترددون على بعض المستشفيات الخاصة في مدينة عدن، اليمن.

تم جمع 78 عينة من مجرى البول من المرضى الموجودين في بعض المستشفيات والمراكز الخاصة الموجودة في عدن - اليمن، خلال الفترة من يناير إلى أغسطس 2021. تم فحص عينات البول بالعين المجهرية والميكروسكوبية. كما تم استنبات العينات في أوساط مختلفة ثم حضنت هوائياً لمدة 18-24 ساعة عند 37 درجة مئوية. تم عزل وتشخيص البكتريا ومن ثم فحص العزلات البكتيرية ومدى حساسيتها للمضادات الحيوية باستخدام طريقة الانتشار القرصي (كيربي- باور).

من 78 عينة كانت 57 (73.08%) موجبة لنمو البكتريا الممرضة و 3 (3.85%) فطريات بينما 3 (3.85%) كانت سلبية و 15 عينة تم استبعادها لعدم اكتمال البيانات. تم الحصول على معدل أعلى من العزلات سالبة الصبغة 33 (55%) مقارنة بالبكتريا الموجبة الصبغة 24 (40%). وبلغت نسبة الإصابة عند الإناث 48 (55%) بينما كان عدد الذكور 12 (20%). كانت أعلى إصابة مسجلة هي *Streptococcus agalactiae* 57/12 (21%)، تليها *Pseudomonas aeruginosa* 9 (15.7%)، ثم *Enterococcus faecalis*، و *Enterobacter aerogenes* ، و *Escherichia coli* الكل من 6 (10.5%). سجلت أعلى حساسية 94.7% بالمضادات الحيوية الليفوفلوكساسين والسيبروفلوكساسين. لكن البكتيريا سالبة الجرام المعزولة أظهرت حساسية بنسبة 100%. أظهرت البكتيريا سالبة الجرام حساسية معتدلة ضد التتراسيكلين 58%، الجنتاميسين 42% و سيفترياكسون 45.5%. بينما لوحظ انخفاض معدلات الحساسية لكل من Co-Trimoxazole 31.6%، Cefotaxime 15.8%، Ampicillin / Sulbactam 15.8%. أظهر سيفالكسين ولينزوليد وكلوكساسيللين مقاومة كاملة للمضادات الحيوية المستخدمة. هناك انتشار كبير للعدوى البكتيرية في المسالك البولية بين النساء. الليفوفلوكساسين هو المضاد الحيوي الأكثر فعالية في علاج عدوى المسالك البولية، يليه أميكاسين، أوفلوكساسين وسيبروفلوكساسين. أمبيسلين / سولباكتام، كو-تريموكسازول، سيفوتاكسيم، تازوباكتام / ببراسيلين. يعتبر المضادات الحيوية الأكثر مقاومة للبكتيريا المعزولة من عدوى المسالك البولية.

أكدت النتائج مقاومة بكتيريا المسالك البولية المعزولة لبعض المضادات الحيوية المستخدمة في دراستنا. وبناءً على ذلك، نوصي أطبائنا بمراعاة التطورات في استخدام المضادات الحيوية ومقاومة البكتيريا للمضادات.

الكلمات المفتاحية: Streptococcus agalactiae، Pseudomonas aeruginosa، عدوى المسالك البولية.

How to cite this article:

K. N. Q. Salem, A. A. Mohammed, A. K. Abdul-Malik, A. Q. Mohammed, F. A. Ali, K. W. Ahmed, M. N. Mahmoud, R. H. Ali and S. S. Mohammed, "ISOLATION AND ANTIMICROBIAL SUSCEPTIBILITY PROFILES OF MICROORGANISMS CAUSING URINARY TRACT INFECTION AMONG PATIENTS IN ADEN CITY, YEMEN", *Electron. J. Univ. Aden Basic Appl. Sci.*, vol. 3, no. 3, pp. 163-175, Sep. 2022. DOI: https://doi.org/10.47372/ejua-ba.2022.3.182