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Bacterial responsibility and Antibiotic sensitivity in Urinary Tract Infection

Hussein A. Abdel Fadel , Mervat G. Hassan, Sabah A. Abo El-Maaty, Dina M. Baraka
Botany and Microbiology Dept., Faculty of Science, Banha University, Egypt
E-Mail: hussein_mohamed85@azhar.edu.eg

Abstract

Escherichia coli is the most frequent infecting organism in acute infection. So, knowledge about the frequency and distribution of urinary tract infection (UTI) is important to improve infection control measures. The aim of this research was to determine the prevalence of bacteria isolated from urinary tract infection (UTI) in patients and determination of the antibiotic susceptibility patterns of the Gram-negative bacteria. We evaluated 43 positive culture patients were collected over a period of 6 months starting from Jun, 2022 until December 2022 on patients attending various clinical in Egypt. The bacteria were isolated from different ages. Gram-negative bacteria were responsible for 69.8% of the isolates, while Gram-positive were responsible for 30.2%. *Escherichia coli* was the most prevalent pathogen. Regarding the susceptibility profile, results found Imipenem was the effective antibiotic against bacterial isolates. This study showed that the frequency of *Escherichia coli* increases the probability of urinary tract infection. Also, this survey indicates the emergence of antibiotic resistant infections in the studied clinics. So, there is a need to improve the effectiveness of integrated infection control programs to control and manage nosocomial infections caused by highly resistant organisms.

Key words : Gram-negative bacteria, *Escherichia coli,* Urinary tract infection, antibiotic susceptibility

1. Introduction

Gram-negative bacteria include *Escherichia coli*, *Klebsiella* species, *Enterobacter* species, and Proteus species can cause urinary tract infections (UTIs). The most frequent organism that causes hospital-acquired UTIs and community-acquired UTIs is *Escherichia coli*, [1] which frequently results in major secondary health problems [2]. A number of variables, including age, gender, immunosuppression, and urological equipment, can influence the frequency of UTIs. Finding the bacteria that cause UTIs and examining their resistance to routinely administered antibiotics in clinical settings are crucial steps towards enhancing the effectiveness of empirical treatment [3]. Treatment costs, morbidity, and mortality rise when multidrug-resistant (MDR) Escherichia coli causes a UTI.

Microorganisms' resistance patterns differ depending on the location, ranging from big to tiny hospitals and from hospitals to communities. The empirical usage of cephalosporins and ciprofloxacins is under threat due to the introduction of extended spectrum beta-lactamase. Microorganisms gain resistance through a variety of processes. Finding the bacteria that cause UTIs and their resistance to routinely administered antibiotics in clinical settings is crucial for enhancing the effectiveness of empirical treatment [4]. Therefore, the purpose of this study was to identify the pathogenic organisms causing UTIs and to ascertain the pattern of antibiotic susceptibility among Egyptian patients.

2. Materials and methods

Sample collection

During the course of six months, from June 2022 to December 2022, 43 positive samples for urinary tract infections were taken from patients visiting the clinic in Egypt. The bacteria came from a variety of genders and ages.

Urinary tract infection bacterial isolate

For sample inoculation, a variety of media types were utilized, including mannitol salt (MSA) (Oxoid, Basingstoke, UK), blood, and MacConkey. For 48 hours, all plates were incubated at 37°C until growth was evident. Lab positive cultures were defined as those that showed any size of bacterial growth on one or more inoculation plates. We did not consider the lower or upper bounds of bacterial growth when reporting the presence of bacterial growth.

Isolates identification

Observe the features of each expanding colony. Additional biochemical testing and the Gram stain are used to identify pathogens. Furthermore, in compliance with the manufacturer's instructions, all isolates were species-identified using the VITEK® 2 compact system (bioMérieux, France).

Antibiotics Susceptibility

In accordance with the standards of the Clinical and Laboratory Standards Institute (CLSI), the antibiotic susceptibility of the isolated bacteria was tested using a disc diffusion method [5]. The CLSI recommendations were used to evaluate the zone diameter (mm) of the sensitivity. 15 antibiotics that, using the conventional disk diffusion approach fall into the beta and non-beta-lactam agent groups [6]. Antibiotic sensitivity testing was done on Mueller-Hinton agar using following antibiotic discs Vancomycin, Gentamicin, Sulfamethoxazol/Trimithoprim, Chloramphenicol, Amoxicillin-clavulanic acid, Erythromycin, Levofloxacin, Imipenem, Oxacillin, Amikacin, Ciprofloxacin, Ceftazidime, Tetracycline, Clindamycin and Penicillin G.

3. Results

Observation of 43 positive culture patients were indicated 26 samples from female and 17 from male, on the other hand 32 from adult and 11 children Table (1).

Table (1) Isolation and microscopic data of 43 UTI positive cultures.

Specimen No.	Gender	Age	Gram stain*	Cell shape
1.	Male	37	-ve	Rod
2.	Male	20	-ve	Rod
3.	Male	34	+ve	Cocci
4.	Child Female	8	-ve	Rod
5.	Male	23	+ve	Cocci
6.	Child Male	8	+ve	Cocci
7.	Child Male	10	-ve	Rod
8.	Male	35	-ve	Rod
9.	Male	21	+ve	Cocci
10.	Female	28	-ve	Rod
11.	Male	23	-ve	Rod
12.	Male	28	-ve	Rod
13.	Male	55	-ve	Rod
14.	Male	46	+ve	Cocci
15.	Male	25	-ve	Rod
16.	Male	33	-ve	Rod
17.	Female	23	-ve	Rod
18.	Child Female	11	-ve	Rod
19.	Female	24	-ve	Rod
20.	Female	23	-ve	Rod
21.	Female	51	-ve	Rod
22.	Child Male	7	-ve	Rod
23.	Female	22	-ve	Rod
24.	Female	29	+ve	Cocci
25.	Female	28	-ve	Rod
26.	Female	36	+ve	Cocci
27.	Child Female	5	-ve	Rod
28.	Child Male	11	+ve	Cocci
29.	Child Male	10	-ve	Rod
30.	Female	26	+ve	Cocci
31.	Female	41	-ve	Rod
32.	Child Female	12	-ve	Rod
33.	Female	45	+ve	Cocci
34.	Female	22	-ve	Rod
35.	Female	36	-ve	Rod
36.	Female	52	-ve	Rod
37.	Female	61	+ve	Cocci
38.	Female	63	-ve	Rod
39.	Child Female	5	-ve	Rod
40.	Female	38	+ve	Cocci
41.	Child Female	9	-ve	Rod
42.	Female	30	+ve	Cocci
43.	Female	48	-ve	Rod

* (+ve) positive, (-ve) negative.

Gram stain used for primary identification and classification of isolates. Gram-negative bacteria were recorded 30 isolates, while Gram-positive were observed at 13 isolates Fig (1).

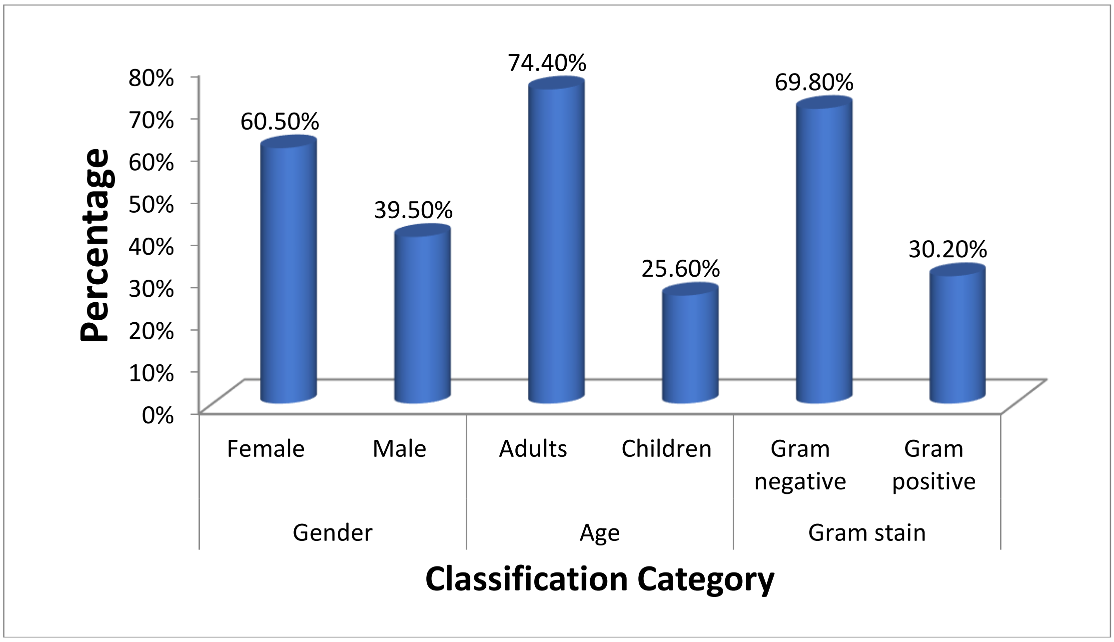

Fig (1) Classification analysis of isolation data of UTI positive cultures.

Based on the biochemical reactions and the culture features of the isolates and deferential medium mentioned in the materials and techniques section. Using the VITEK® 2 compact system, gram-positive and negative microorganisms were identified. According to the results, Escherichia coli was the most often found pathogen for UTI, accounting for 22 out of 43 isolates. Staphylococcus spp., which was detected in 13 out of 43 isolates, was the second pathogen in UTIs. The findings showed that 8 strains of Pseudomonas aeruginos were found in the clinical case that was investigated. Figure 2 displayed the distribution % of pathogenic bacterial strains from UTI.

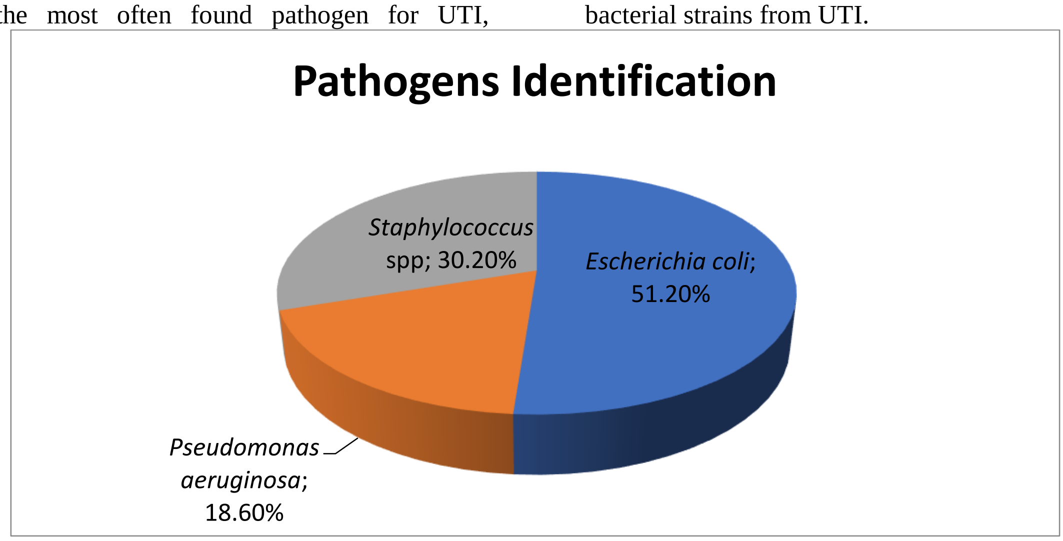

Fig (2) Identification of UTI positive cultures isolates

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The bacterial strains showed variation in the inhibition zone diameter (mm) on different types of antibiotic discs and selected according to their antibiotic resistant against the beta-lactams groups. Imipenem recorded the most potency against *Pseudomonas aeruginosa* (100%), *Staphylococcus* spp (85%) and *Escherichia coli* (77%). Results show at Table (2).

Table (2) Antibiotics sensitivity of UTI strains

Antibiotics	Symbol & Disk Potency	Pathogens		
		Escherichia coli (22)	*Pseudomonas aeruginosa* (8)	*Staphylococcus spp* (13)
Vancomycin	VA 30 µg	14 (64%)	6 (75%)	11 (84.6%)
Gentamicin	CN 10 µg	13 (59%)	3 (37.5%)	5 (38.5%)
Cotrimoxazol (Sulfamethoxazol/ Trimithoprim)	SXT 25 µg	3 (14%)	4 (50%)	2 (15%)
Chloramphenicol	C 30 µg	10 (45.5%)	2 (25%)	7 (54%)
Amoxicillin-clavulanic acid	AMC 30 µg	6 (27%)	2 (25%)	3 (23%)
Erythromycin	E 15 µg	1 (4.5%)	2 (25%)	2 (15%)
Levofloxacin	LEV 5 µg	12 (54.5%)	3 (37.5%)	6 (46%)
Imipenem	IPM 10 µg	17 (77%)	8 (100%)	11 (85%)
Oxacillin	OX	16 (73%)	6 (75%)	7 (54%)
Amikacin	AK 30 µg	6 (27%)	2 (25%)	8 (61.5)
Ciprofloxacin	CIP 5 µg	11 (50%)	3 (37.5%)	8 (61.5)
Ceftazidime	CAZ 30 µg	3 (14%)	2 (25%)	1 (8%)
Tetracycline	TE 30 µg	12 (54.5%)	2 (25%)	7 (54%)
Clindamycin	DA 2 µg	11 (50%)	5 (62.5%)	4 (31%)
Penicillin G	P 10 IU	10 (45.5%)	3 (37.5%)	3 (23%)

4. Discussion

Urinary tract bacterial infections are one of the most common reasons people in the community seek medical assistance. The identification of the bacterial isolate and the choice of an efficient antibiotic drug for treatment are critical components of the appropriate care of patients with bacterial UTIs.

The most common illness in women, UTIs are frequently brought on by bacteria. The MDR-caused *E. coli* UTI the rise in *E. coli* in recent years is most likely attributable to the excessive and unwarranted use of antibiotics. The distribution of species and how susceptible they are to antibiotics varies geographically and historically.

In our study, the bulk of urinary isolates were from female patients (60.5%) as UTIs are frequent in females due to short urethra. The most common urinary tract bacteria was found to be *E. coli* (51.2%), a frequent causative agent of UTIs. *E. coli* was the most predominant species isolated in our study population.

Our study and this one are complementary. However, Teferi et al.'s report from 2023 [7] indicates that 25.4% of hospitalized gynecological cases had a UTI. With 37.6% of the isolates, *Escherichia coli* was the most prevalent pathogen, followed by *Klebsiella* spp. The most potent results were obtained by IPM against 100% of *Pseudomonas aeruginosa*, 85% of *Staphylococcus* species, and 77% of *Escherichia coli*.

A similar study conducted at Imam Reza hospital laboratory located in Tabriz city, East Azerbaijan province, northwest of Iran, during March 2012 to February 2013 [4]. Study showed that *E. coli* (55.38%) was the most common isolated pathogen, followed by *Enterobacter spp.* (29.61%), *Pseudomonas spp.* (4.9%), *S. aureus* (3.21%), *Enterococcus spp.* (2.3%), *fungi* (1.5%) and *Klebsiell*a (0.48%). The sensitivity rates of isolated gram negative bacteria were for Amikacin (95.7%), Nitrofurantoin (91.5%), Gentamicin (64.1%), Ceftizoxim (56.8%), Ciprofloxacin (37.6%), Cotrimoxazole (31.4%) and Nalidixic acid (23.5%).

According to the susceptibility and resistance profile of all isolates in the study conducted in Egypt for Makharita et al. (2016) [8], imipenem and ciprofloxacin had better efficacies than vancomycin and erythromycin.

Much of the world, particularly in developing nations where traditional medicine is the main source of treatment for a wide range of illnesses, has long used plant extracts to treat infections. Several studies have demonstrated the potential of plant extracts and essential oils in medical operations as well as in the food, cosmetic, and pharmaceutical industries [9]. To support clinical care, information about the microbiological profile and antibiotic susceptibility of UTI patients is helpful [10].

4.Conclusion

Gram-negative and Gram-positive bacteria accounted for 69.8% and 30.2%, respectively, of the isolates used to assess the bacteriological profile and susceptibility pattern of UTI. The pathogen with the highest prevalence was *Escherichia coli* (51.2%). IPM was the only antibiotic that was effective against all *P. aeruginosa* bacteria. Evidence-based clinical therapy benefits from knowing a patient's microbiological profile and antibiotic susceptibility.

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