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Short Article

Epidemiology of Urinary Tract Infection and Antibiotic Resistance Pattern in Patients Referred to Amiralmomenin Hospital of Gerash City in 2018

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ABSTRACT

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Background and Aims: Urinary tract infections are one of the most common human infections seen in all age groups and both sexes. Inappropriate use of antibiotics to treat urinary tract infection causes the resistance of the pathogens to the drug. The present study aimed to determine the frequency of gram-negative and gram-positive bacteria and antibiotic resistance patterns in patients with urinary tract infection.

Materials and Methods: Samples were cultured on Blood Agar and Eosin Methylene Blue. Colonies' growth was identified by biochemical tests and standard microbiological and antibiotic sensitivity tests, which were performed with the disc diffusion method according to the Clinical and Laboratory Standards Institute 2016 Standard.

Results and Conclusions: The isolated bacteria showed the highest susceptibility to imipenem (89.66%) and meropenem (87.21%) and the highest resistance to sulfamethoxazole (50.00%) and nalidixic acid (44.09%). So, using imipenem is recommended as the most effective antibiotic for the treatment of infection.

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Introduction

Despite widespread advances in the medical and healthcare fields in recent years, infectious diseases are still considered as a major cause of mortality and serious concern of World Health Organization [1]. Urinary tract infections (UTIs) are the most common non-intestinal infections found in humans. It is caused by a variety of gram-negative and gram-positive bacteria and, in some cases, by fungi [2]. So, about 150 million people worldwide get the infection annually, and 13,000 of them die from UTI [3].

In addition to the death rate caused by this infection, the lack of proper diagnosis, treatment and timely diagnosis lead to severe complications such as urinary tract disorders, permanent renal parenchymal damage, especially in children, hypertension, bacteremia, uremia, preterm labor and even abortion in pregnant women [4]. Also, ineffective treatment will cause relapse in the short term. In 20 to 50% of patients with UTI, recurrence of the infection was observed in less than six months after the first infection. Apart from the health issues of this complication, the social costs of UTIs, including the costs of health care as well as the wasted time of affected workers and employees, put a great deal of economic pressure on the country, which adds to the importance of this issue. The social costs of UTIs in the United States have estimated at 3.5 billion dollars annually, which is equivalent to the costs of treating angina pectoris and Cohen's disease [5]. Increased antibiotic resistance is a global problem because the unnecessary use of antibiotics will cause the spread of resistant pathogens [6]. A gradual increase in antibiotic resistance caused increased complications due to the disease, increased duration of treatment and using multiple antibiotics [3]. According to the cases mentioned above, the choice of medication for the treatment of UTI should be based on the pattern of resistance in the geographical area, drug sensitivity, and antibiogram tests. Since receiving the result of urine culture and its antibiogram takes at least 48 hours, experimental treatment should be started based on the antibiotic resistance patterns in the geographical area obtained from previous research, especially in the sensitive people, such as children and pregnant women [1, 4]. So, this study aimed to determine the frequency of UTI bacterial agents and their antibiotic resistance patterns in hospitalized patients and outpatients referred to Amiralmomenin Hospital in Gerash city. In addition to helping physicians to choose appropriate drugs, the results from this research will be effective in reducing the costs of patients' treatment.

Materials and Methods

This descriptive cross-sectional study was performed on 6751 hospitalized patients, and outpatients referred to Amiralmomenin Hospital in Gerash city in 2018. After assuring about no catheterization and antibiotic use in two weeks before the patient was referred to the laboratory, urine samples were collected from the middle part of the urine stream in sterile

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containers. Demographic data including age, sex, and type of admission were recorded, and samples were cultured on Blood Agar (BA) and Eosin Methylene Blue (EMB) (made by Merck German Company) for up to 30 minutes after sampling with a standard loop at 0.01 volume. The cultures were placed in the incubator at 37˚C for 24 h. After this period, if 105 bacteria per ml of a colony-forming unit of urine was found, it is intended as an infectious sample. Otherwise, the samples were kept in the incubator at 37˚C for another 24 h. Colonies are grown by biochemical tests, and standard microbiological environments, including warm staining, catalase, coagulase, bacitracin sensitivity, novobiocin sensitivity, urease, Triple Sugar Iron Agar (TSI) differential environment, indole production test, Sulfide Indole Motility (SIM), and 6.5% NaCl tolerance test.

Determination of antibiotic

Susceptibility was tested using eleven antibiotic discs (PattenTeb, Iran) including ciprofloxacin (5 µgr), nitrofurantoin (300 µgr), cefixime (5µgr), imipenem (10 µgr), amikacin (30 µgr), ceftazidime (30 µgr), cefotaxime (30 µgr), sulfamethoxazole (25 µgr), gentamicin (10 µgr), nalidixic acid (30 µgr), meropenem (10 µgr) via disk diffusion method and after preparation of microbial suspension equivalent to Half McFarland according to the Clinical and Laboratory Standards Institute (CLSI) guidelines; CLSI 2016 was performed on Mueller Hinton Agar medium [1]. Data were analyzed by the SPSS software version 21 using the Chi-square test ($P<0.05$).

Results and Discussion

Of 6751 cultured urine samples, 337 (4.99%) positive cultures of UTI were observed. Out of these patients, 236 (70.03%) were outpatients, and 101 (29.97%) were inpatients. The most infectious wards were pediatric (10.39%), emergency (10.09%) and internal (5.04%), respectively. Of 337 positive cultures, 201 were female (59.64%), and 136 were male (40.36%). Patients' age ranged from one day to 105 years, with a mean age of 31.92 years and a standard deviation of 28.24 years. Most infections are in the age range below ten years. Examination of the frequency of bacteria showed that 73.89% of the bacteria had formed gram-negative and 26.11% gram-positive. The frequency of isolated bacteria has come in table 1.

The results of antibiotic susceptibility testing showed that the bacteria were most susceptible to imipenem (89.66%) and meropenem (87.21%), and most resistance was to sulfamethoxazole (50.00%) and nalidixic acid (44.09%), respectively. According to the results, the most sensitive antibiotics for gram-negative and gram-positive were meropenem (89.39%) and imipenem (95.00%), as well as the most resistant antibiotic between gram-negative and gram-positive bacteria, were sulfamethoxazole (56.38%) and ceftazidime (58.62%), respectively. In *Escherichia coli*, which had the highest frequency among the infectious agents, the highest sensitivity was to imipenem antibiotic (88.44%), and the highest resistance was to sulfamethoxazole (56.36%). The results of the antibiotic susceptibility test can be observed in table 2.

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Table 1. Frequency of bacteria isolated from urine samples

Bacteria	Frequency	Frequency percentage
Escherichia coli	216	64.09
Staphylococcus epidermidis	50	14.84
Treptnon hemolytic	28	8.31
Klebsiella pneumoniae	17	5.04
Pseudomonas aeruginosa	10	2.97
Staphylococcus saprophyticus	4	1.19
Proteus mirabilis	3	0.89
Streptococcus viridans	2	0.59
Group D streptococcus	2	0.59
Enterobacter	1	0.30
Providencia	1	0.30
Flavobacter	1	0.30
Beta-Hemolytic Streptococcus	1	0.30
Micrococcus	1	0.30
Total	337	100

Table 2. Distribution of antibiotic susceptibility of bacteria isolated from urine culture

Antibiotics	Gram-negative bacteria			Gram-positive bacteria			Total		
	Sensitive (%)	Medium effect (%)	Resistant (%)	Sensitive (%)	Medium effect (%)	Resistant (%)	Sensitive (%)	Medium effect (%)	Resistant (%)
Ciprofloxacin	135 (69.95)	7 (3.63)	51 (26.42)	29 (46.77)	12 (19.35)	21 (31.57)	164 (64.31)	19 (7.45)	72 (28.24)
Nitrofurantoin	124 (77.50)	14 (8.75)	22 (13.75)	56 (91.80)	2 (3.28)	3 (4.92)	180 (81.45)	16 (7.24)	25 (11.31)
Cefixime	91 (55.49)	1 (0.61)	72 (43.90)	20 (39.22)	9 (17.65)	22 (43.14)	111 (51.63)	10 (4.65)	94 (43.72)
Imipenem	177 (88.06)	12 (5.97)	12 (5.97)	57 (95.00)	1 (1.67)	2 (3.33)	234 (89.66)	13 (4.98)	14 (5.36)
Amikacin	85 (78/70)	16 (14/81)	7 (6/48)	14 (56/00)	2 (8/00)	9 (36/00)	99 (74/44)	18 (13/53)	16 (12/03)
Ceftazidime	133 (67.17)	15 (7.58)	50 (25.25)	18 (31.03)	6 (10.34)	34 (58.62)	151 (58.98)	21 (8.20)	84 (32.81)
Cefotaxime	105 (58.01)	9 (4.97)	67 (37.02)	36 (81.82)	0 (00.00)	8 (18.18)	141 (62.67)	9 (4.00)	75 (33.33)
Sulfamethoxazole	80 (42.55)	2 (1.06)	106 (56.38)	35 (54.69)	9 (14.06)	20 (31.25)	115 (45.63)	11 (4.37)	126 (50.00)
Gentamicin	150 (73.89)	13 (6.40)	40 (19.70)	31 (48.44)	7 (10.94)	26 (40.63)	181 (67.79)	20 (7.49)	66 (24.72)
Nalidixic Acid	45 (48.39)	7 (7.53)	41 (44.09)	0 (00.00)	0 (00.00)	0 (00.00)	45 (48.39)	7 (7.53)	41 (44.09)
Meropenem	59 (89.39)	3 (4.55)	4 (6.06)	16 (80.00)	0 (00.00)	4 (20.00)	75 (87.21)	3 (49.3)	8 (9.30)

UTI is one of the most common bacterial infections, and the cause of this infection is mostly bacteria, especially gram-negative bacteria, such as *Escherichia coli*, that can be seen in all age groups and both sexes [7]. The microbial cause of UTIs is well known, and the characteristics of pathogens of UTIs, especially antimicrobial resistance, are changing [8]. Due to the increased prevalence of UTIs, it is important to determine the antibiotic resistance pattern of the bacteria, causing it.

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Based on the antibiogram results obtained from this study, *Escherichia coli* with 64.09% and *staphylococcus* with 14.84% are the most common organisms the cause UTIs but in the study of Molazadeh et al. and Aghamahdi et al., Klebsiella was the most abundant after *Escherichia coli*. In this study, infected people were mostly women, which is in line with Heydari et al. and some other studies stating that UTI was more common in women [9].

According to the results, the most sensitive antibiotics for gram-negative and gram-positive bacteria were meropenem (89.39) and imipenem (95.00%), as well as the most resistant antibiotics for gram-negative and gram-positive bacteria, were sulfamethoxazole (56.38%) and ceftazidime (58.62%). In the study of Raeeszadeh et al., the highest and the lowest sensitivity of *Escherichia coli* were nitrofurantoin and sulfamethoxazole, respectively [10]. Similarly, in the present study, *Escherichia coli* shows the lowest sensitivity to sulfamethoxazole (56.36%), while the highest sensitivity was observed in imipenem (88.44%).

In this study, the best treatment for UTI is imipenem, which from the 337 bacteria isolated, 234 (89.66%) were sensitive. This finding was consistent with the previous studies [11, 12]. Most infections were in the age group of fewer than ten years, which may be due to poor immune systems. Whereas, in a study conducted by Heydari et al., the infection was mostly reported in old age groups [9].

Conclusion

The isolated bacteria in this study indicated high resistance to common antibiotics in the treatment of UTIs and sensitivity to imipenem. Consequently, using imipenem as the most effective antibiotic for the treatment of UTI is highly recommended.

Conflict of Interest

The authors declare that they have no conflict of interest.

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