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Determining Antibiotic Resistance Pattern of the Bacteria Isolated from Urine Samples of Patients Attending Imam Khomeini Hospital in the City of Ahvaz, Iran in 2013

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Infectious diseases are one of the most important causes of mortality in the world, especially in the developing countries. Resistance to antibiotics is a big problem in the treatment of infectious diseases. Identifying common pathogenic strains and their antibiotic resistance is necessary for appropriate treatment. The pattern of antibiotic resistance in every town, and even every hospital in a town is different. The present study aims to determine antibiotic resistance pattern in bacteria isolated from urine samples of outpatients attending Ahvaz Imam Khomeini Hospital (Ahvaz, Iran). This was a descriptive epidemiological study performed in Ahvaz Imam Khomeini Hospital (Ahvaz, Iran) in 2013. For this purpose, all the positive cultures from outpatients were examined. In addition, identification of bacteria was done by microbiological methods and their antibiotic resistance was measured according to Kirby-Bauer method (using Antibiogram discs). Of the 189 positive cultures, *Escherichia coli* (*E. coli*) with 128 (67.72%), *Klebsiella* with 23 (12.16%), coagulase-negative staphylococci with 11 (5.28%), Streptococcus with nine (4.76%), Enterococcus with nine (4.76%), Pseudomonas with four (2.11%), Acinetobacter with three (58/1%), and Proteus with two cases (05/1%) were respectively the most common bacteria isolated. The percentages of antibiotic resistance in general were as follows: trimethoprim-sulfamethoxazole (56.39), nalidixic acid (55.49), cefazolin (54.27), cefixime (49.56), ceftriaxone (48.26) ciprofloxacin (37.52), gentamicin (26.55), and nitrofurantoin (12.71). In Gram-positive bacteria, in addition to the aforementioned antibiotics, resistance to three antibiotics of erythromycin, imipenem, and vancomycin were 62.68, 11.26, and 0 percent, respectively. This study showed that among drugs that are used as initial treatment of urinary tract infections, nitrofurantoin and ciprofloxacin have the lowest resistance and cotrimoxazole, nalidixic acid, and cefazolin have the highest resistant.

Key words: Outpatient, Drug resistance pattern, Urine sample.

Infectious diseases are major causes of death in the world and according to the World Health Organization statistics, 49% of deaths occurring in developing countries are due to infectious diseases[1, 2].

With the discovery of antibiotics, along with improvements in lifestyle, improved diagnostic techniques, and higher levels of health, drastic reduction in infectious diseases were seen, however, some types of microbes were able to survive antibiotics such that microbes over time are more likely to become resistant with proper mutation. This will cause the increase in the cost and complications of this problem[3].

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Frequent and ongoing use of antibiotics leads to increased reproduction and spread of resistant strains of bacteria. Improper use of antibiotics is due to prescribing too much medicine, prescribing insufficient doses, inappropriate treatment, and wrong diagnosis[4].

Resistance to a drug means that bacteria growth cannot be stopped by the concentrations of the drug that is absorbed by the patient[4]. Bacterial resistance can be internal resistance (natural insensitivity of all members of a species of bacteria to antimicrobial drugs) or acquired resistance and insensitivity of certain strains of a species of bacteria to antimicrobial drugs[5, 6].

Given the widespread prescription, excessive use of drugs, and increased costs of drug therapy, the need to assess the process of the operation of drugs is felt. Antibiotics should be prescribed based on the type of microbes due to the risks of drug resistance[7].

Although choosing initial treatment of an infection often takes place based on experience, availability of susceptibility tests helps in the adjustment of initial dose or moderation and modification of treatment due to the following reasons: (A) microorganisms causing infection are resistant to the drug taken, (B) a drug with same effect and lower price can be substituted[8].

Despite existing monitoring system for antimicrobial resistance surveillance in Iran, available data published on patterns of resistance to antimicrobial drugs in bacteria originated from hospitals and society is limited[9].

Identifying common pathogenic strains and their antibiotic resistance is necessary for appropriate treatment. Since antimicrobial resistance patterns in every city and even in every hospital is different and also due to the lack of similar studies available in Ahvaz and Imam Khomeini hospital especially from outpatients, it is necessary to examine antibiotic resistance pattern in urinary pathogens isolated from outpatients of this hospital. Also, due to constantly changing resistance patterns and even the type of pathogen causing the disease over time, it is necessary to carry out fundamental study to determine the speed and the trend of changing of this pattern, for it to be a basis for planning and timing similar studies. Therefore, we decided to determine the antibiotic resistance pattern of the bacteria isolated from urine samples of outpatients attending Imam Khomeini hospital of the city of Ahvaz.

MATERIALS AND METHODS

This study was performed retrospectively on all outpatients attending the medical laboratory of Imam Khomeini hospital in Ahvaz with symptoms suggestive of urinary tract infection during 2013. Sterile mid-stream urine sample was collected from all attended patients and was cultureed in blood agar and MacConkey agar growth media and after 48 hrs sight and existence of 105 colony counts per millilitre of urine was considered as the positive culture. In these cases, the sensitivity of urinary pathogens to cefazolin, cefixime, ceftriaxone, ciprofloxacin, gentamicin, nalidixic acid, nitrofurantoin, and cotrimoxazol antibiotics and in the case of gram-positive bacteria to vancomycin, erythromycin, imipenem antibiotics (in addition to the aforementioned antibiotics) in the treatment of urinary tract infections was determined. Patients with a history of urinary tract infection or with a long term catheter use and also those who had taken antibiotics before admission or had a history of hospitalization in the past two weeks were excluded from the study. The data were analyzed with statistical package of SPSS (version 20) using descriptive statistics.

RESULTS

The total numbers of positive cultures were 189 cases. The most common isolated pathogen was *E. coli*, which was responsible for

Table 1. The frequency of bacteria isolated from urine of patients visiting Imam Khomeini hospital in Ahvaz

Type of bacteria	Numbers	Percentage
E. coli	128	67.72
Klebsiella pneumoniae	23	12.16
Coagulase-negative staphylococci	11	5.82
Enterococcus	9	4.76
Alpha-hemolytic streptococci	9	4.76
Pseudomonas aeruginosa	4	2.11
Acinetobacter baumannii	3	1.58
Proteus Mirabilis	2	1.05
Total	189	100

Table 2. Antibiotic resistant of bacteria isolated from urine of outpatients attended Imam Khomeini hospital of Ahvaz to differentiate according to the strains of bacteria

Bacteria / antibiotics	Cefazolin	Cefixime	Ceftriaxone	Ciprofloxacin	Nalidixic acid	Gentamicin	Nitrofurantoin	Cotrimoxazole
E. coli	54.8	45.8	47.6	43.7	63.2	21.3	9.4	59.5
Klebsiella pneumoniae	50	45	33.3	30.4	39.1	26.1	21.7	52.4
Coagulase-negative staphylococcus	28.6	70	66.7	0	0	11.1	0	9.1
enterococci	100	66.7	33.3	44.4	0	50	0	88.9
Alpha-hemolytic streptococci	20	66.7	100	11.1	100	80	0	37.5
Pseudomonas aeruginosa	100	100	50	50	100	50	100	75
Acinetobacter baumannii	66.7	0	0	0	0	0	33.3	33.3
Proteus mirabilis	50	50	65	50	100	100	100	100

128 cases (67.7%) of positive cultures. Then, *Klebsiella pneumoniae* with 23 and Coagulase-negative staphylococcus with 11 cases had the highest frequencies (Table 1).

The highest antibiotic resistance in isolated E. coli was to cefazolin 54.8%, Nalidixic Acid 63.2%, and cotrimoxazole 59.5%, in isolated *Klebsiella pneumonia* was to cotrimoxazole 52.4% and 50% cefazolin, in isolated Coagulase-negative staphylococci was to the cefixime70% and ceftriaxone 66.7%, and in the case of other bacteria (*Streptococcus, Enterococcus, Pseudomonas aeruginosa, Acinetobacter* and *Proteus*) antibiotic resistance has been listed in Table 2.

In general, the highest antibiotic sensitivity was to nitrofurantoin (85.71 percent) and gentamicin (70.27 percent). The highest resistance was to Trimethoprim-sulfamethoxazole

Table 3. Antibiotic resistance in all bacteria isolated from patients attended Imam Khomeini hospital in Ahvaz

Antibiotic	Resistant	Intermediate	Sensitive
Cefazolin	54.27	7.31	38.42
Cefixime	49.56	3.42	47.02
Ceftriaxone	48.26	6.93	44.81
Ciprofloxacin	37.52	7.96	54.52
Gentamicin	26.55	3.18	70.27
Nalidixic acid	55.49	5.48	39.03
Nitrofurantoin	12.71	1.58	85.71
Trimethoprim-sulfamethoxazole	56.39	1.07	42.54

Table 4. Antibiotic resistance in Gram-positive bacteria isolated from patients attended Imam Khomeini in Ahvaz

Antibiotic	Resistant	Intermediate	Sensitive
Cefazolin	48.08	5.42	46.50
Cefixime	67.95	3.79	28.26
Ceftriaxone	66.66	22.96	10.38
Ciprofloxacin	17.22	17.23	65.55
Gentamicin	44.55	0	55.45
Nalidixic acid	31.03	25.3	43.67
Nitrofurantoin	0	0	100
Trimethoprim-sulfamethoxazole	42.67	0	57.33
Imipenem	26.11	0	73.89
Vancomycin	0	42.67	57.33
Erythromycin	68.62	25.17	6.21

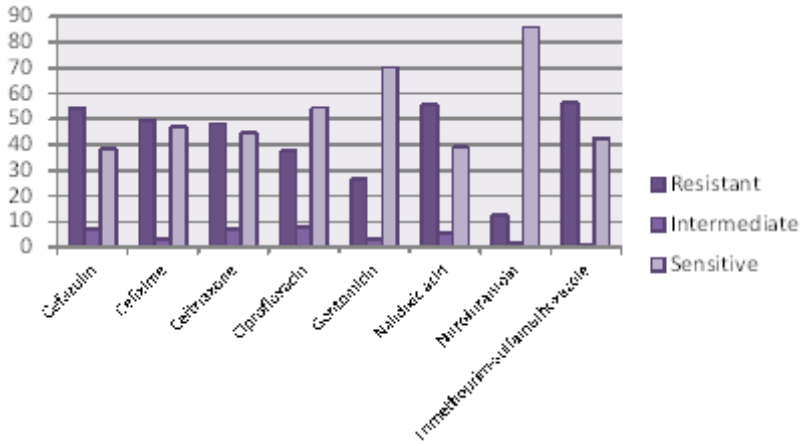

Fig. 1. The pattern of antibiotic resistance in bacteria isolated from urine of outpatients attended Imam Khomeini hospital in Ahvaz in 2013

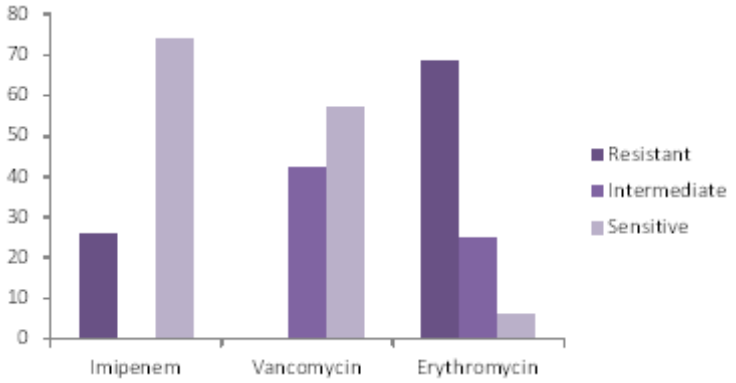

Fig. 2. Antibiotic resistance in Gram-positive bacteria isolated from urine of outpatients attended Imam Khomeini hospital in Ahvaz to 3 antibiotics (erythromycin, vancomycin, imipenem)

(56.39 percent), nalidixic acid (55.49 percent), and cefazolin (54.27 percent) (Table 3).

In Gram-positive bacteria the highest resistance was to erythromycin (68.62%) and the highest sensitivity was to nitrofurantoin (100%) (Table 4).

DISCUSSION

In our study, the most common pathogen isolated from urine samples was E. coli that its highest resistance was to cefazolin, co-trimoxazole, and nalidixic acid and its highest sensitivity was to nitrofurantoin and ciprofloxacin. The most common pathogen among Gram-positive bacteria was coagulase-negative staphylococci, which had the highest resistance to erythromycin, ceftriaxone, and cefixime.

Predominance of E. coli in our study is consistent with the Martinsalas's study during 2003-2004 in Spain, Hamidi Farahani during 2008-2009, Mowlazadeh during 2012-2013 in Fasa, Iran, and Kanani in 2006 in Kermanshah, Iran[10-13]. The highest sensitivity of *E. coli* in our study is related to nitrofurantoin and ciprofloxacin, which in the study of Hamid Farhani the highest sensitivity was to norfloxacin and nitrofurantoin. This agreement is due to the fact that in both studies urine samples have been examined and the higher sensitivity to nitrofurantoin is probably due to the low use of antibiotics in two societies[11].

In Mowlazadeh's study, the highest sensitivity has been to ciprofloxacin, gentamicin, nitrofurantoin, and ceftriaxone, which can be

attributed to the increased use of ceftriaxone and gentamicin in our study area[12]. In Lashkari's study, in 2009 - 2010 in Tehran, the highest antibiotic sensitivity of E. coli has also been to nitrofurantoin and the highest resistance has been to nalidixic acid, which is consistent with our study[14]. In Asefzadeh's study in Qazvin, Iran in 2007, the highest sensitivity was nitrofurantoin, and resistance to ceftriaxone and ciprofloxacin was above 50%, which is consistent with our study[15]. *Klebsiella pneumoniae* is the most common strain of *E. coli* in our study that in the C.Martinsalas's study was the third strain after salmonella that may be because of the differences in the type of samples, which in our study was only urine, but in that study stool, and throat and ear discharges were also studied[10]. The highest resistance has been to cotrimoxazole and cefazolin and the highest sensitivity has been to nitrofurantoin and gentamicin. Contrary, the study of Jalalpoor conducted in Esfahan during 2009 to 2010, reported high level of resistance for Klebsiella pneumoniae to cefazolin[16]. This difference is probably because numbers of samples in our study were higher and also we examined other samples in addition to urine. In the Sadeghi's study in Tehran and Tabriz in Iran during 2003- 2004, the resistance of Klebsiella to ceftriaxone and cefixime in Tabriz has been 36.4% and 54.3% and in Tehran has been 48.04% and 43.73%, respectively[17]. In our study, coagulase-negative staphylococci have been the most common gram-positive pathogen, which had the highest resistance to cefixime, ciprofloxacin, and erythromycin and has had no resistance to ciprofloxacin, nalidixic acid, and nitrofurantoin. Predominance of coagulase-negative staphylococci in our study is consistent with the Martinsalas's study[10].

CONCLUSION

Our findings showed that Gram-negative pathogens are more common among outpatients. There is a higher resistance to trimethoprim-sulfamethoxazole, cefazolin, nalidixic acid, ceftriaxone, and cefixime antibiotics, but compared to two antibiotics of nitrofurantoin and gentamicin a lower resistance was observed.

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