ORIGINAL ARTICLE

Urinary tract infection among intellectual disability individuals "Etiology and antibiotic resistance patterns" in rehabilitation centers of Mazandaran province, Northern Iran

M. NASROLAHEI, M. POORHAGIBAGHER, M. VAHEDI, I. MALEKI*
Department of Microbiology and Virology, School of Medicine, Mazandaran University of Medical Sciences, Sari, Iran;
* Department of Gastroenterology, Imam Hospital, Mazandaran University of Medical Sciences, Sari, Iran

Key words

Intellectual disability • Urinary tract infection • Rehabilitation center • Antimicrobial resistance • Iran

Summary

Objective. *Urinary tract infections (UTIs) are amongst the most common infections and account for large proportion of antibacterial drug consumption. The aim of this study was to determine the rate and the etiologic agents of UTIs in inhabitants of rehabilitation centers of Mazandaran province in northern Iran and to evaluate the antimicrobial susceptibility patterns of the uropathogens isolated.*
Methods. *Clean catch midstream urine sample was collected from each of 314 participants (163 males, 151 females) residing in 12 rehabilitation centers of Ramsar, Nowshahr, Chalous, Amol, Sari and Behshahr. Urine specimens were cultured and bacterial isolates were identified by conventional methods. All urines fulfilling the criteria for the presence of significant bacteriuria ($\geq 10^4$ cfu / ml urine) were defined as positive. Antibiotic susceptibility testing was performed by Kirby-Bauer disc diffusion method.*
Results. *The rate of urinary tract infection was 30.9% with the highest rate in pediatrics ($p < 0.0001$).The prevalence of UTIs were shown to be higher in females than in males with the rate of 46.3% in young aged females (20-29 years), 60% in middle aged group (40-49 years) and 50% in elderly (> 50 years). Bacteria most frequently isolated from urine specimens was Escherichia coli (39.2%) with the highest rate of infection in females age group < 10 years ($p < 0.001$). Among the antibiotics tested against the isolated organisms for susceptibility test, ceftriaxone and gentamicin maintain good activity against the majority of gram negative bacteria that cause UTIs recovered from individuals with intellectual disability. Vancomycin was effective against Staphylococcus aureus.*
Conclusions. *This survey shows that the prevalence of UTIs among inhabitants of institutions for mentally retarded persons in Mazandaran province of Iran is much higher than normal population.*

Introduction

Urinary tract infections (UTIs) are amongst the most common infections and account for large proportion of antibacterial drug consumption. Worldwide, about 150 million people are diagnosed with UTI each year, costing the global economy in excess of 6 billion US dollars [1, 2].
The etiology of UTI and the antibiotic resistance of uropathogens have been changing over the past years, both in community and nosocomial infection [3, 4].
The infections range from a single acute symptomatic infection, with a susceptible organism which may develop a spontaneous cure, to a more serious recurring infection such as chronic pyelonephritis which may be caused by resistant, and often difficult to treat, organisms.
Previous studies have shown that *Escherichia coli* is the predominant cause of UTIs both in and outside hospitals. Recent studies in North America and Western Europe demonstrated increasing resistance in UTI *E.coli* to ampicillin, trimethoprim and sulfonamides [5-8].

Since UTI is a very common infectious disease, all individuals are susceptible to urinary tract infections; however, the prevalence of infection differs with age, sex, and certain predisposing factors including mental abnormalities [9].
However, there is not only much information on etiology of UTIs among inhabitants of institutions for mentally retarded persons in Iran but also the susceptibility pattern of uropathogens is still unknown. We decided to analyze demographic characteristics and distribution of microorganisms causing UTIs in these individuals and to study their resistance pattern to antibiotics. This study is important for empiric treatment of individuals with mental retardation who have UTI and the data would also help authorities to formulate antibiotic prescription policies in rehabilitation centers.

Materials and methods

This descriptive study was conducted between April and December 2011 on individuals with intellectual disability residing in 12 rehabilitation centers of Mazandaran prov-

ince, northern Iran. These centers had a total residential population of 660, of which, 32 patients that used antimicrobial agents in the previous 2 months were excluded from the study. However, since there was not published data on the rate of UTIs in patients with intellectual disability in Iran, the sample size was calculated as 314 participants on a prevalence of 50%, d = 0.05 at a confidence level of 95%. Participants were 1-69 years old (mean = 26.53 ± 12.15 years) and toilet themselves independently.

Freshly voided midstream specimens of urine (n = 314, 151 from females and 163 from males) were submitted to the clinical microbiology laboratory of Sari Medical School, Mazandaran University of Medical Sciences for processing. Data on age, gender, previous UTI and the use of antibiotics in the past two months were recorded for each individual.

Semi quantitative urine culture using a calibrated loop was used to inoculate blood agar and MacConkey plates [10]. The growth was quantified and bacteria were identified according to standard procedures [11]. A culture was defined as positive if $\geq 10^4$ cfu/ml of probable urinary pathogens were found (significant bacteriuria). More than two microorganisms in one positive culture were considered as contamination.

Susceptibility test was performed using Kirby-Bauer disk diffusion method according to Clinical Laboratory Standards Institute (NCCLS) guidelines [12].

The antibiotic disks (Padtan Teb, Tehran, Iran) comprised: amoxicillin (10 µg), vancomycin (30 µg), tetracycline (30 µg), nitofurantoin (300 µg), ceftriaxone (30 µg), ciprofluxazin (5 µg), gentamicin (10 µg) and trimethoprim-sulfamethoxazole (25 µg).

The research project was approved by the Research Ethics Committee of Mazandaran University of Medical Sciences, Sari, Iran.

Statistical analysis

Data were analyzed by the SPSS statistical package program. A descriptive univariable analysis was performed to evaluate the frequency of the variables. The associations between categorical variables were identified using the Chi-square and fisher,s statistical exact tests at a significant level of 5%.

Results

Of 314 urine specimens processed, 97 (30.9%) showed significant bacteriuria. The rate of UTI was 19.2% for female subjects and 11.7% for male subjects. Distribution of Urinary tract infection in relation to gender and age of study population in rehabilitation centers of three geographical regions of Mazandaran province is shown in Table I.

The prevalence of UTI were shown to be highest in individuals residing in rehabilitation centers of western Mazandaran province (42.6%) with no statistically differences in male and female subjects ($p > 0.05$). The lowest rate of infection were identified in residents of rehabilitation centers in center of Mazandaran province (17.5%, $p < 0.0001$, $X^2 = 21.93$, df = 2), with predominance in females than in males (27.8% *vs.* 14.8%, p = 0.05).

In this survey, the rate of UTI in female subjects age group < 10 years was 100% *(*$p < 0.0001$). This rate were shown 46.3% in young aged females (20-29 years), 60% in middle aged females (40-49 years) and 50% in elderly (> 50 years). In male subjects, the highest rate of UTI were identified in age groups < 10 years (75%, $p < 0.001$) and in elderly (33.3%).

Of 97 significant isolates, gram-negative aerobic rods accounted for 85.5% while gram-positive cocci comprised the remaining 14.5% of the total pathogens. In the present study the most frequently isolated species from UTIs were *Escherichia coli* (*E. coli)* (39.2%) and *Enterobacter spp* (30.9%) followed by *Klebsiella pneumoniae* (9.3%), *Proteus spp* (6.2%), *Enteococcus fecalis* (8.2%) and *Staphylococcus aureus* (6.2%).

Table II presents the distribution of pathogens according to gender and age. *E. coli*, *Enterobacter spp* and *K. pneumoniae* were the major pathogens in two sexes. In < 10 years aged female group, all isolates were *E. coli* with a constant reduction according to increase in age in favor of other uropathogens. In the > 50 years old female groups, 33.3% of the positive cultures were due to *E. coli*.

In male subjects of < 10 years, the lowest rate of UTIs was caused by *E. coli,* but an increasing in the isolation rate of this uropathogen according to increase in age with slight variation were noted. In elderly (> 50 years), there was not significant differences in the rate of UTIs caused by *E. coli* in males and females (p = 0.1).

Enterobacter spp, *K. pneumoniae* and *S. aureus* were more frequent isolates in males than in females with significant differences in pediatrics ($p < 0.05$).

E. fecalis were responsible for UTIs more frequently in females than in males but the differences were not statistically significant *(*p = 0.2). Resistance pattern to antibiotics is shown in Table III. The susceptibility testing profiles of *E.coli* showed low level of resistance against gentamicin (13.1%), tetracycline, ciprofloxacin, cotrimoxazole and nitrofurantoin (26.3% each). Sixty three percent of *E. coli* and 96.7% of *Enterobacter spp* isolates were fully susceptible to ceftriaxone. Of 38 *E. coli* isolated, 36.9% were shown moderate sensitivity to ceftriaxone. No resistance of *K. pneumoniae* and *Proteus spp* isolates against ceftriaxone and gentamicin were observed.

Resistance rate of *Enterobacter spp to* cotrimoxazole and ciprofloxacin was (86.6%) and (53.3%) respectively. Twenty of 30 *Enterobacter spp* isolated (66.6%) were susceptible to gentamicin and 33.3% have shown moderate susceptibility to the drug.

Three of 6 *S. aureus* strains isolated (50%) were susceptible to vancomycin and 100% of the isolates were susceptible to gentamicin. In *E. fecalis* the highest level of resistance to cotrimoxazole were identified (62.5%).

Discussion

This study provides current information regarding the prevalence rate and the etiologic agents of UTIs in indi-

Tab. I. Distribution of UTIs by gender and age in individuals with intellectual disability residing in Rehabilitation centers of three geographical regions of Mazandaran province, northern Iran, 2011 (N = 314).

Rehabilitation centers		Male	Age	Groups	(Years)			Female	Age	Groups	(Years)	
	< 10 (N* = 12)	10-19 (N* = 30)	20-29 (N* = 45)	30-39 (N* = 24)	40-49 (N* = 37)	> 50 (N = 15)	< 10 N* = 1	10-19 N* = 27	20-29 N* = 54	30-39 N* = 47	40-49 N* = 20	> 50 N = 2
Central Province n (%)	5 (83.3)	2 (18.2)	3 (9.7)	0 (0)	2 (10.5)	1 (12.5)	1 (100)*	2 (14.3)	6 (35.3)	1 (25)	0 (0)	0 (0)
Western Province n (%)	4 (66.6)	3 (15.8)	3 (21.4)	6 (100)	4 (22.2)	4 (00)	0 (0)	3 (27.3)	17 (61)	13 (36.1)	11 (57.9)	1(100)
Eastern Province n (%)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (50)	2 (22.2)	1 (14.3)	1 (100)	0 (0)
Total n (%)	9 (75)*	5 (16.6)	6 (13.3)	6 (25)	6 (16.2)	5 (33.3)	1 (100)*	6 (22.2)	25 (46.3)	15 (32)	12 (60)	1 (50)

* ($p < 0.001$).

Tab. II. Age and gender wise distribution and frequency of uropathogenes isolated from individuals with mental retardation residing in rehabilitation centers of Mazandaran province, northern Iran, 2011.

Age groups	Uropathogens											
	E. coli		*Enterobacter* spp		K. pneumoniae		Proteus spp		E. fecalis		S. aureus	
	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)
< 10	22.2	100	44.4	0	11.1	0	11.1	0	0	0	22.2	0
10-19	40	33.3	20	33.3	20	16.6	0	0	20	0	0	16.6
20-29	66.6	36	33.3	32	0	8	0	12	0	12	0	0
30-39	33.3	40	33.3	40	0	6.6	16.6	0	0	6.6	16.6	6.6
40-49	50	40	16.6	30	16.6	10	0	0	0	10	16.6	10
> 50	40	33.3	20	0	20	0	0	33.3	20	33.3	0	0

viduals with mental retardation in northern Iran. Our findings enable the rate of UTI in individuals with intellectual disability to be compared with the rate of the infection in normal populations reported by other investigators.

Community acquired UTI is a predominant infectious disease especially in women. In this survey the proportion of UTI in female subjects were higher than in males (19.2% *vs.* 11.7%). Our results are consistent with recently published studies performed on different age groups in normal populations, which have been extensively reported that women have a higher prevalence of UTI than men, principally owing to anatomic, microflora and physical factors [9, 13-15].

Current survey showed that the rate of UTI among children (< 10 year age) with intellectual disability was higher than those of other age groups (100% in girls and 75% in boys). It should be noted that the total number of pediatrics residing in rehabilitation centers of Mazandaran province was lower than those of other age groups and most of them had UTI, so the rate of the infection represented higher in this group.

In our study the rate of UTI in inhabitants of rehabilitation centers of western Mazandaran province was higher than those residing in other institutions under study. These centers have certain limitations that are inherent to medical and laboratory base facilities. For example, some of rehabilitation centers of western Mazandaran province are very far from academic institutions for medical cares which itself provides difficulties in the diagnosis and treatment of patients and influences on the number of such cases.

In our survey, the rate of infection caused by *E. coli* was 39.2% which is similar to those reported by other investigations in normal populations; 32% [16], and 40% [17]. With respect to the causes of UTIs in our series, the rate of UTI caused by *E. coli* was 100% in girls under 10 ($p < 0.001$), but the incidence decreased according to the increase in age with a little variation and persisted in elderly. Males presented an increasing in the isolation rates of *E. coli* up to 29 year age and with a slight variation its persistence were identified in elderly. These findings show that *E. coil is* the most common cause of UTIs in the residents of rehabilitation centers of northern Iran particularly in females with similar rate of incidence in normal populations as shown by many reports [7, 18-20].

Enterobacter spp, K. pneumoniae and *S. aureus* were moderately predominant in males. As known, UTI in men is often associated with diagnostic and /or therapeutic instrumentations in the genitourinary tract especially prostate; these procedures usually expose patients to UTI [21, 22]. In our survey therapeutic instruments were not used by any individuals residing in the centers under study. The higher rate of infection in males caused

Tab. III. Frequency and resistance pattern of uropathogens against antibiotics tested/

Microorganisms identified	No. of isolates & percent of occurrence				Percentage (%) of resistance against antibacterial agents				
		Co	Ci	Cf	G	T	Nf	V	AMP
E.coli	38 (39.2)	26.3	0	26.3	13.1	26.3	26.3	-	-
Enterobacter spp	30(30.9)	86.6	3.3	53.3	3.3	10	86.6	-	-
K.pneumoniae	9(9.3)	77.7	0	33.3	0	22.2	44.4	-	-
Proteus pp	6 (6.2)	100	0	100	0	33.3	66.6	-	-
E.fecalis	8(8.2)	62.5	-	12.5	12.5	12.5	-	12.5	12.5
S.aureus	6(6.2)	100	-	50	0	50	-	50	-

Co = cotrimoxazole; Ci = ceftriaxone; Cf = ciprofloxacin; G = gentamicin; T = tetracycline; Nf = nitrofurantoin; V = vancomycin; AMP = ampiicillin.

by some of these bacteria may be due to the prostate problems that have not been identified and treated.

Proteus spp are rarely encountered in cases of community-acquired UTIs. In the present study, *6.2% of Proteus spp* isolates were found to be present among all uropathogens studied, as shown by others [4, 13].

In individuals with mental retardation, the rate of UTI caused by *S. aureus* was 6.2% with predominance in males ($p < 0.05$).There is an increased incidence of infection with *S. aureus* in association with urinary tract obstruction, neoplasm, and manipulation [23]. Prior to antimicrobial therapy, *S. aureus* was the leading cause of hematogenous infection of the kidney and perinephric abscesses.

The incidence of *E. fecalis* in our study was 8.2%, with the rates of 75% in females and 25% in males. Our data are consistent with Gupta et al. [24] and Rosa Daza et al. [25] findings, who have shown significantly higher proportion of UTI caused by *E. fecalis* in women.

Although there are not much published reports concerning UTIs in individuals with intellectual disabilities, the prevalence of the infection in our study (30.9%) is much higher than those of many other studies conducted in normal population in different parts of Iran including, in two pathobiology laboratories of Tehran 6.3% [26], in a 374-bedded educational hospital, Shiraz 1.82% [27] in 5136 samples from patients suspected of having UTI, northwest of Iran 13.2% [28] and in other countries, 5.9%, 18.89% and 27% [29-31], however the type and distribution of uropathogens isolated are similar to above mentioned reports. These differences in prevalence may result from host factors, environmental conditions, and practices such as health care and hygiene practices in different populations.

Antibiotic resistance is a major clinical problem in treating infections caused by most gram negative microorganisms. The resistance to the antimicrobials has increased over the years. Resistance rates vary from country to country. Overall, isolates from Latin American countries show the lowest susceptibility rates to all antimicrobial agents followed by Asian-Pacific isolates and European strains [4, 32-34].

In the present study most *E. coli isolates* from individuals with intellectual disability were susceptible to the drugs commonly used in general practice such as ceftriaxone, cotrimoxazole, ciprofloxacin, nitrofurantoin, gentamicin and tetracycline.

Regarding quinolones, nitrofurantoin and cotrimoxazole, even though we did not find statistical significances, there is a trend towards high resistance rates of other gram-negative bacteria rather than *E. coli* in our geographic area.

In the current survey, the rate of resistance against ciprofloxacin (53.3%, 100%, 33.3%), nitrofurantoin (86.6%, 66.6%, 44.4%) and cotrimoxazole (86.6%, 100%, 77.7%), among Enterobacter spp, Proteus spp and K. pneumoniae collected from residents of rehabilitation centers in northern Iran were high. *E. faecalis* showed no special resistance to the drugs habitually used in UTI except against cotrimoxazole. In the present survey, only 12.5% of *E. fecalis* isolates were resistant to the drug. The large use of antimicrobial agents in our geographic area during the past decade has contributed to the selection of a high number of resistant uropathogens.

In our study, while ceftriaxone and gentamicin presented good activity against the majority of isolates, vancomycin and gentamicin demonstrated excellent in vitro activity against *S. aureus* isolates recovered from UTI in individuals with mental retardation.

However, due to the narrow spectrum of antibiotics tested in this survey, no definitive conclusion can be drawn and the results cannot be compared with other reports in this respect.

Data presented in this survey, indicates that the prevalence of UTIs among inhabitants of institutions for mentally retarded persons in north and centeral regions of Mazandaran province are lower than in western areas. Our findings indicate that sponsors and staff of these institutions are fully trained for taking care of individuals with mental retardation and have medical knowledge regarding control and prevention of UTIs in these individuals.

Antibiotics commonly used in UTIs are still effective, but species distribution and their susceptibility to antibiotics are changing in general all around the world. It requires regular monitoring in order to make reliable information available for optimal empirical therapy of UTIs among inhabitants of rehabilitation centers.

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■ Correspondence: Maryam Poorhagibagher, Department of Microbiology, Sari Medical School, Mazandaran University of Medical Sciences, PC 48168-95475-18th km of Khazar abad Road, Sari, Iran - Tel. +98 9111587234 - Fax +98 151 3543249 - E-mail: mnasrolahei@yahoo.ca