ORİJİNAL ARAŞTIRMA ORIGINAL RESEARCH

The Microbial Agents of Urinary Tract Infections at Central Laboratory of Dr. Shariati Hospital, Tehran, IRAN

Dr. Shariati Hastanesi (Tahran, İRAN) Merkez Laboratuvarında Saptanan İdrar Yolu Enfeksiyonu Mikrobiyal Ajanları

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ABSTRACT Objective: The aim of this study, was to determine the incidence and variety of microbial agents cause Urinary Tract Infections in patients who refered to Central Laboratory of Dr. Shariati Hospital, during 1 year (June 2004- June 2005). **Material and Methods:** As a retrospective epidemiological investigation, the recorded data were reviewed and collected by the questionnaires consisting of short-answer questions. Finally, the statistical analyses of Chi Square were done by SPSS software version 15. **Results:** The results of this study indicated that, there were 13 different microbial agents involved in Urinary Tract Infections. The microorganisms respectively were: *Escherichia coli*, *Streptococcus spp.*, *Klebsiella spp.*, *Staphylococcus spp.*, *Acinetobacter spp. Candida albicans*, *Pseudomonas aeruginosa*, *Proteus spp.*, *Enterobacter spp.*, *Citrobacter spp.*, Diphtheroids, *Morganella morganii* and *Salmonella spp.* **Conclusion:** *Escherichia coli*, was the most frequent microbial agent of Urinary Tract Infections and most of the microorganisms isolated were from women. In spite of the variety of pathogenic microorganisms, in the most cases, the association between Urinary Tract Infections and female gender was significant.

Key Words: Epidemiology, microbial agents, urinary tract infections

ÖZET Amaç: Bu çalışmanın amacı, 1 yıl içerisinde (Haziran 2004-Haziran 2005) Dr. Shariati Hastanesi Merkez Laboratuvarı'na idrar yolu enfeksiyonu nedeniyle gönderilmiş olan örneklerdeki mikrobiyal ajanların insidansı ve değişkenliğini belirlemektir. **Gereç ve Yöntemler:** Kayıt edilen veriler retrospektif epidemiyolojik araştırma olarak derlendi ve kısa sorulu anketler ile toplandı. Son olarak, SPPS ver.15 ile ki-kare testi yapılarak istatistiksel analiz yapıldı. **Bulgular:** Bu çalışmanın sonucunda idrar yolu enfeksiyonuna yol açan 13 değişik mikrobiyal ajan saptandı. Sırasıyla mikroorganizmalar; *Escherichia coli, Streptococcus* türleri, *Klebsiella* türleri, *Staphylococcus* türleri, *Acinetobacter* türleri, *Candida albicans, Pseudomonas aeruginosa, Proteus* türleri, *Enterobacter* türleri, *Citrobacter* türleri, *Difteroid*'ler, *Morganella morganii* ve *Salmonella* türleridir. **Sonuç:** İdrar yolu enfeksiyonlarında en çok saptanan ajan *Escherichia coli*'dir ve mikroorganizmaların çoğunluğu kadın hastalardan izole edilmiştir. Patojenik mikroorganizmaların değişkinliğine rağmen, çoğu durumda idrar yolu enfeksiyonu ve kadın cinsiyet arasında anlamlı ilişki saptanmıştır.

Anahtar Kelimeler: Epidemiyoloji, mikrobiyal ajanlar, idrar yolu enfeksiyonu

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Urinary tract infections (UTIs) are a serious health problem affecting millions of people each year and are the second most common type of infection in the human body.[1,2] UTIs can be divided anatomically into upper- and lower-tract infections. In males, lower-tract diseases include prostatitis, epididymitis, cystitis and urethritis. But, upper-tract disease (pyelonephritis) is similar in males and females. Besides, UTIs can be symptomatic or asymptomatic.[3,4]

Urine and urinary tract normally are sterile. The normal urine contains fluids, salts, and waste products, but it is free from bacteria, viruses, and fungi.[1]

By the help of adhesins such as pili (i.e. fimbriae) and outer membrane proteins (e.g. Dr hemagglutinin), uropathogenic *Escherichia coli* causes 90% of the UTIs in anatomically-normal, unobstructed urinary tracts.[5-7] After *E. coli*, the most common UTIs pathogens include *S. saprophyticus*, *Enterococcus spp.*, *Pseudomonas aeruginosa*, *Candida* spp, *Klebsiella pneumonia*, *Proteus spp.* and *Enterobacter spp.*. Group B *streptococci* are uncommon pathogens in UTIs in young healthy women.[8-11]

Different studies have shown that, women are more prone to UTIs than males. An estimated 40 percent of women report having had a UTI at some point in their lives.[12] The large difference in UTI prevalence between men and women is thought to result from a variety of factors including: the greater distance between the anus and the urethral meatus in men, the drier environment surrounding the male urethra, the greater length of the male urethra and the antibacterial activity of prostatic fluid.[13]

The risk factors of UTIs are sexual activity in young women, loss of lactobacilli in elderly women, urologic structural abnormalities, diabetes, immunosuppression, pregnancy, hypertension, stone formation, recent hospitalization or urologic tract manipulation such as use of diaphragm, spermicide or catheterization, individual hygiene and social behaviors.[11,12,14,15]

However, the rate of mortality in microbial UTIs patients is low, the anatomical position of infection and the kind of risk factors are very important.[4,6]

The purpose of this study was to determine the incidence and variety of the causative microbial agents of UTIs in patients who refered to Central Laboratory of Dr. Shariati Hospital, during 1 year (June 2004- June 2005).

MATERIAL AND METHODS

In this project, the positive microbial UTIs patients with or without clinical symptoms of UTIs were retrospectively studied.[16] For data collection, the authors constructed a questionnaire consisting of short-answer questions such as Microbial agent, Diagnostic approaches, Sex and Age of patients, Risk factors and Mortality.

In the present study, the patients who referred to the Central Laboratory of Dr. Shariati Hospital were investigated, during 1 year (June 2004- June 2005).

Where as, the questionnaires were filled from recorded data at the Central Laboratory and the name of patients were completely anonymous for the authors, so there was no need to informed consent form and the institutional ethical review board.

Finally, the percentage of UTIs cuased by different microbial agents was calculated. Besides, the association between sex and UTI was analyzed through Chi Square (χ^2) test. SPSS version 15 (SPSS Inc., Chicago, IL, USA) was used to process the data. A p value of < 0.05 was considered as statistically significant.

RESULTS

The percentage of causative microbial agents of UTIs and the sex of the patients are as bellow:

I. The rate of UTIs caused by *E. coli* was 47.4% (Table 1, Figure 1). In this case, 28.8% of urogenital infections were seen in men and 71.2% in women.

II. *Streptococcus spp.* caused 13% of UTIs (Table 1, Figure 1). Totally, 44.4% of Streptococcal urogenital infections were seen in men and 55.6% in women. Besides, D group *Streptococci* caused 14.3%, *Enterococcus spp.* 38.6% and *Streptococcus spp.* 47.1% of urogenital infections.

III. The rate of UTIs caused by *Klebsiella spp.* was 10.2% (Table 1, Figure 1). In this case, 31.4% of urogenital infections were seen in men and 68.6% in women. Besides, *Klebsiella* oxytoca

TABLE 1: UTIs Microbial agents. Also, the frequency and percentage of UTIs patients is shown.

Microbial Agents	Frequency	Percent (%)
Escherichia coli	813	47.4
Streptococcus spp.	223	13.0
Klebsiella spp.	175	10.2
Staphylococcus spp.	136	7.9
Acinetobacter spp.	102	5.9
Candida albicans	101	5.9
Pseudomonas aeruginosa	87	5.1
Proteus spp.	33	1.9
Enterobacter spp.	24	1.4
Citrobacter spp.	12	0.7
Diphtheroids	5	0.3
Morganella morganii	3	0.2
Salmonella spp.	1	0.1
Total	1715	100.0

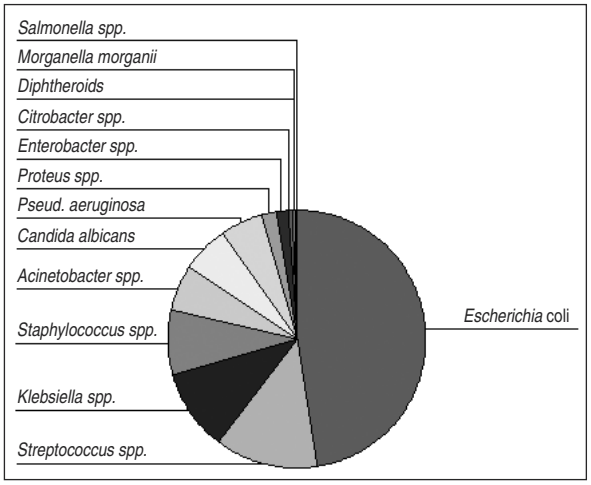

FIGURE 1: Microbial agents of UTIs.

caused 7.4% UTIs and the other 92.6% were caused by *K. pneumoniae*.

IV. *Staphylococcus spp.* caused 7.9% of UTIs (Table 1, Figure 1). Totally, 54.4% of *Staphylococcal* urogenital infections were seen in men and 45.6% in women. Besides, *S. saprophyticus* caused 2.2%, *Staphylococcus spp.* 14%, *Staphylococcus aureus* 14%, *Staphylococcus haemolyticus* 16.2% and *Staphylococcus epidermidis* 53.6% of infections.

V. The rate of UTIs caused by *Acinetobacter* was 5.9% (Table 1, Figure 1). In this case, 55% of urogenital infections were seen in men and 45% in women.

VI. *Candida albicans* caused 5.9% of UTIs (Table 1, Figure 1). In this case, 31.7% of urogenital infections were seen in men and 68.3% in women.

VII. The rate of UTIs caused by P*seudomonas aeruginosa* was 5.1% (Table 1, Figure 1). In this case, 60.9% of urogenital infections were seen in men and 39.1% in women.

VIII. *Proteus spp.* caused 1.9% of UTIs (Table 1, Figure 1). In this case, 24.2% of urogenital infections were seen in men and 75.8% in women. Besides, *Proteus spp.* caused 30.3%, *Proteus mirabilis* 60.6% and *Proteus vulgaris* 9.1% of infections.

IX. The rate of UTIs caused by *Enterobacter spp.* was 1.4% (Table 1, Figure 1). In this case, 33.3% of urogenital infections were seen in men and 66.7% in women. Besides, *Enterobacter aerogenes* caused 91.7% and *Enterobacter cloaceae* 8.3% of infections.

X. *Citrobacter spp.* caused 0.7% of UTIs (Table 1, Figure 1). In this case, 75% of urogenital infections were seen in men and 25% in women. Besides, *Citrobacter freundii* caused 58.3% and *Citrobacter diversus* 41.7% of infections.

XI. *Diphtheroids* were isolated from 0.3% of patients (Table 1, Figure 1). But, these organisms were not pathogenic strains. *Diphtheroids* were detected as contaminants and isolated only from women as microbial contamination.

XII. The rate of UTIs caused by *Morganella morganii* was 0.2% (Table 1, Figure 1). *M. morganii* was isolated only from women.

XIII. *Salmonella spp.* caused 0.1% of UTIs (Table 1, Figure 1). *Salmonella spp.* was isolated only from men.

Identification of all UTIs causative microorganisms was performed by classic microbiologic methods. In other word, Diagnosis of UTIs was based on urine culture on different microbiological media such as Blood Agar, ENDO Agar and Mac Conkey Agar. The diagnosis methods were also included Direct microscope observation, Gram staining, Biochemical tests, Antibiogram, Oxidase and Catalase tests. But, no molecular test such as PCR was performed.

The age of patients nor the risk factors (except in some general cases) for individuals was available for the authors; so these items were withdrawn from the study. But, in the reports, the general risk factors in patients who were referred to the central laboratory of Dr. Shariati were mentioned as sexual activity in young women, surgery, diabetes, immunosuppression, transplants, pregnancy, hypertension, stone formation, hospitalization and catheterization. Besides, the level of individual hygiene and social behaviors was included. Also, the risk factors for cases of *Staphylococcus spp.*, *Acinetobacter spp.*, *Pseudomonas aeruginosa*, *Citrobacter spp.*, and *Salmonella spp.*, in men was generaly reported as catheterization and urologic procedures.

No mortality was reported during the investigation period.

DISCUSSION

IInfections of the urinary tract are second in frequency only to upper respiratory infections. All individuals are susceptible to UTIs; However, the prevalence of infection differs with age, sex and certain predisposing factors. The incidence of infection peaks at certain times during life and is associated with both age and sex. Throughout life, the incidence of infection is greater in females than in males with two exeptions, infants and catheter-related infections.[14,17]

However, the normal urine is free from bacteria, fungi and viruses, but the presence of microorganisms alone in a urine specimen does not establish significance because bacteriuria can occur from colonization and contamination as well as infection. Contamination occurs when organisms from the external genitalia, urethra or periurethral skin enter the specimen during collection. Contaminants include *diphtheroids*, lactobacilli, coagulase-negative *staphylococci* and viridans *streptococci*. The presence of squamous epithalial cells, but no WBC, confirms the contamination.[14]

In an epidemiologic study at University of California Irvine Medical Center, the prevalent of microbial pathogens were isolated from urine specimens. As a result from the study, *E. coli* was the most common isolated microorganism. The other microbial pathogens isolated were respectively: *Enterococci, Klebsiella spp.*, *Pseudomonas aeruginosa*, *Candida spp.*, *Proteus mirabilis*, *Enterobacter spp.*, Group B s*treptococci, Citrobacter spp.*, *Staphylococcus aureus*, *S. saprophyticus* and others.[14]

TABLO 2: Chi-Square Tests (between sex and UTIs) are shown.

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	101.978	12	.000
Likelihood Ratio	103.053	12	.000
Linear-by-Linear Association	24.884	1	.000
N of Valid Cases	1715		

In our investigation which, was done at Central Laboratory of Dr. Shariati Hospital, the isolated microbial agents are respectively: *E. coli*, *Streptococcus spp.*, *Klebsiella spp.*, *Staphylococcus spp.*, *Acinetobacter spp.*, *C. albicans*, *Pseudomonas aeruginosa*, *Proteus spp.*, *Enterobacter spp.*, *Citrobacter spp.*, *Diphtheroids*, *M. morganii* and *Salmonella spp.*.

In both investigations which was done at the University of California Irvine Medical Center and Central Laboratory of Dr. Shariati Hospital, *E. coli* was the most important microbial agent of UTIs and there were some common pathogenic microorganisms. Besides, the statistical method of χ^2 showed the significant association between female gender and UTI caused by *E. coli* ($P<0.05$)

In conclusion, as expected, *E. coli*, was the most frequent causative microbial agent of UTIs and despite of different results for diverse pathogenic microorganisms, totally the statistical tests of χ^2 showed the significant association between female gender and UTIs ($p< 0.05$) (Table 2).

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