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# Study of Causative Bacterial Agents of Urinary Tract Infections and Determining Their Antibiotic Susceptibility Pattern in Clients of Tabriz's Clinics

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**Abstract:** Prevalence of urinary tract infections second to respiratory infections constitutes the highest statistics of infections among patients and has ranked first in terms of adult patients' visits with doctor. In infectious diseases such as urinary tract infections, doctors often have to treat the infection before definitive identification of infectious agents and susceptibility testing to antibiotics; therefore, they have to have sufficient information in the context of infections and antibiotic susceptibility. The aim of this study was to determine the prevalence of bacterial agents of urinary tract infections and their antibiotic susceptibility pattern in Tabriz during the year 2011. In this study, 876 urine samples were cultured after being transferred in a completely sterile situation to the microbiology laboratory and finally the total of 135 samples were culture positive. Among the positive cases, the most frequency was related to *E. coli* with 63.7% of the whole positive samples and the highest sensitivity belonged to Ceftriaxone antibiotics with a sensitivity of 53.48% of all reported cases.

**Key words:** Urinary Tract Infection % Antibiotic Susceptibility Determination % Tabriz

## INTRODUCTION

Urinary tract infections are the problems that are faced by millions of people every year. It is estimated that in 1997 more than 3.8 million patients have been referred to physicians because of a urinary tract infection. In most cases, urinary tract infections can manifest as urethritis, but often the infection which spreads to the bladder, urethras and kidneys are likely cystitis and pyelonephritis [1]. Epidemiological studies have shown urinary tract infection is not limited to a particular age but are seen in all age groups, including infants, children, adults and the elderly. Pregnancy provides certain favorable conditions for women to develop UTI. Approximately 2- 4% of pregnant women are diagnosed with urinary tract infection [2].

Morethan 90% of urinary tract infections arecaused bycertain types ofbacterial speciesthat are part ofthe normalfloraof thegastrointestinal tract. *E. coli* is the most prominent cause of bacterial urinary tract infections. Capabilities of more than 150 strains of *E. coli* in colonization in the perineum and urethras and migration to urinary tract are due to the specific virulence factors in these strains (the strains O1, O2, O4, O6, O19, $O_{75}$) [1,3,4].

A variety ofantibioticsare prescribed to treaturinary tract infections. The used antibiotics should be able to completely eliminate the bacteria in the urine sample. In choice ofantibioticsand durationof treatment; patients' history and the urine tests play an important role. Antibiogramtest helps the physician in selecting the most effective and the best antibiotic.It should also be noted that in the treatment of urinary tract infection; the

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concentration of antibiotics in urine is more important than its concentration in serum [5]. Trimethoprim-sulfamethoxazole, amoxicillin, ampicillin, nitrofurantoin and quinolones are commonly used to treat urinary tract infections [1].

In many infectious diseases, including urinary tract infections, the doctor is required to begin treatment before a definitive understanding of the infectious agent and its antibiotic sensitivity.In this case, the doctor must have sufficient information regarding the cause of infection and antibiotic susceptibility to be able to prescribe the proper medication [6].

The aim of thisstudy wasto determine the prevalence of bacterialurinary tract infectionsin Tabriz and their antibiotic susceptibility pattern in clinical patients of the city in 2011.

## MATERIALS AND METHODS

Total of 876 urine sample were prepared during the year 2011 from a number of patients referred to specialized clinics in the city of Tabriz and were immediatelytransferred in sterile containers with dry ice to the microbiology laboratory and get cultured there.

First samples were centrifugedin steriletubes for 10min at 2500rpm and then for purification of precipitate; it was transferred to blood agar, after purification; the two colonies were transferred on both Blood agar and MacConkey agar and by preparation of gram-stained smear, Catalas and Oxidas tests, the type of unknown bacterium was identified. Next by using differential media and biochemical tests and based on species subtraction tables; every attempt was made to identify the species[7].

The modified method of Kirby and Bauer and the NCCLS guidelines were used todeterminethe sensitivity of each of the isolates toantibiotics. The pure colonies grownin tubescontaining 0.5- 1ml of nutrientbrothor Peptone environment and put in the incubatorat 37 °C for 2to 6hours and preparation ofpure liquid culture turbi dity tube with 0.5 Mc Farland, the swab was entered into the tube and then the swab was cultured on plates Muller Hinton agar evenly. Then the discs were placed in appropriate distance by sterile forceps and later the plates were incubated for 24 h at 37°C, inhibition zone was measured after incubation [7].

In this study, 18 antibiotics (nalidixic acid, nitrofurantoin, erythromycin, cefazolin, kanamycin, gentamicin, azithromycin, penicillin, cephalothin, ceftriaxone, cotrimoxazole, ceftizoxime, cefotaxime, vancomycin, amikacin, nitrofloxasine, cefixime and cephalexine) were used.

## RESULTS

The survey's results determine that in under test samples the most frequency belongs to *E. coli* bacterium (63.7% of the whole sample positive) and in the next class Coagulase-negative *staphylococci* and *Klebsiella Pneumonia* (each with 8.89% of the whole sample positive) which all are detailed in the following table (Table 1).

## DISCUSSION

The results showed that *E. coli* was the most common bacteria that cause urinary tract infections in city of Tabriz and 63.7% of urinary tract infections in Tabriz have been created by this bacterium. Findings of this study are relatively consistent with the study conducted by Christians *et al.* in which the prevalence of *E. coli* have been reported 78% [8] and in Papapetropoulou *et al*. research the prevalence of the bacterium have reported 77%. Also the results of this research are different from the study conducted by Yousefi *et al*. which reported the prevalence of 54.2% for the same bacterium [9]. But the finding of this study indicates a high match with the study of Mansouri *et al*. in which have mentioned the prevalence of *E. coli* 67.5%. In present study after *E. coli*, the most common bacteria are *Klebsiella* and coagulase-negative *Staphylococci* (eachwith a frequency of 8.89%) a nd this founding are in contrary to the findings of Mansouri *et al*. in which Klebsiellain fifth rank (with frequency of 5.6%) [10]. Ina survey conducted by Yousefi*et al*. after *E. coli*, coagulase-negative *Staphylococci* with prevalence of 15.4 % and *Klebsiella* with 12.1% prevalence have been mentioned whose results were in agreement with the findings of this study [9]. In study of Christiacns *et al*. *Staphylococcu ssaprophyticus* with a prevalence of 9% were in the second place and *Proteus*, with a prevalence of 4% were in the third position which are different from the results of present research [8]. But a survey of Papapetropoulou and colleagues conducted only on Gram-negative bacteria; the prevalence of *Klebsiella* was 8.7% that are in agreement with results of this study [15]. Also compatible with the results of numerous studies, similar results were observed [11-14].

Table 1: Results obtained from antibiogram test

| Name of isolated bacteria | No. | Percent | The most Sensitive Antibiotic(%) | The most Resistant Antibiotic (%) |
|---|---|---|---|---|
| *E. coli* | 86 | 63.7 | CRO (53.48) | SXT (25.58) |
| *Staphylococcus* spp.(Coagulase Negative) | 12 | 8.89 | CT (41.66); V (41.66) | SXT (33.33) |
| *Citrobacterfrundii* | 11 | 8.24 | CP (45.45); CT (45.45) | SXT (45.45) |
| *Klebsiellapnumoniae* | 12 | 8.89 | CRO (66.66) | SXT (25.00); NA (25.00) |
| *Proteus vulgaris* | 1 | 0.74 | CRO (100.00); CTX (100.00) | SXT (100.00); NA (100.00) |
| Staphylococcus aureus (Coagulase Positive) | 3 | 2.22 | CT (66.66); CP (66.66) | CFM (66.66); CTX (66.66) |
| *Entrobacteraerogenes* | 8 | 5.92 | CRO (50.00); CP (50.00) | SXT (37.50); CFM (37.50) |
| *Psudomonasaeroginosa* | 2 | 1.5 | CP (100.00); NOR (100.00) | CFM (100.00) |

Cro: ceftriaxone; ct: ceftizoxime; v: vancomycin; cp: ciprofloxacin; ctx: cefotaxime; nor: norfloxacin; sxt: cotrimoxazole; na: nalidixic acid; cfm: cefixime

In the case of sensitivity to antibiotics; the results of this study suggest that towards the antibiotics of Ciprofloxacin, the highest sensitivity belongs to *P. irozenaz* (100%) and at the next levels are *Staphylococcus aureus* (66.66%), *Enterobacterirozenaz* (50%), *Citrobacterfroundi* (45.45%). It is noteworthy that the sensitivity to these antibiotics has been reported up to 100% in the study of Yousefi *et al*.which is compatible with the results of the present study [9].

A combination Trimethoperium - sulfamethoxazole with brand name of cotrimoxazole is among the most common antibiotics used to treat urinary tract infections [15]. But based on the results of the present study; high percentage of isolated bacteria has shown resistance to antibiotics i.e. resistance among the isolates of *E. coli* and *Klesiella* 25%, Coagulase-negative *staphylococci* about 33% and the bacteria *Escherichiairozenaz* 37.5% and even in some cases like Proteus it goes up to 100%. It should be noted that the report published by Gales *et al*. (1998) the resistance of Cotrimoxazole among isolates of Escherichia coli have been announced 46.6% and 44% for *Klebsiellapneumoniae* isolates [16]. Also various reports indicate that the level of resistance in different parts of the world varies from 18 to 50 percent which is probably associated with the consumption rate of this drug [15,16].

The new Kinolons like Ciprofloxacin are particularly suitable drugs for treatment of urinary tract infections because in addition to the family *Enterobacteriaceae* is also effective against *Pseudomonas* and in present study they were the most effective antibiotic for most of the bacteria. But with *E. Coli* isolates in this study, the antibiotic resistance of over 20% versus ciprofloxacin is very disturbing. It is notable that the results of the investigation Goettsch *et al*. in 1998 have reported that the resistance of Uropathologic *E. coli* strains is 5.8 percent [17]. It seems that a high percentage of resistance in isolates of *E. coli*of current study may be due to the indiscriminate and inappropriate use of this kind of antibiotic in the region of Tabriz.

In present study the most effective antibiotics were classified as third-generation cephalosporin. So, three antibiotics of ceftriaxone, cefotaxime and ceftizoxim show the highest percentage of sensitivity in different isolates. By comparing the results with similar studies we have witnessed varying degrees of compatibility. So Urassa *et al*. susceptibility to third generation cephalosporin was mentioned by 80%. [18]. Vu-Thien and colleagues have reported this sensitivity to 90% [19]. As well as Papapetropoulou *et al*. have mentioned all isolates sensitive to third-generation of cephalosporin [20].

As can be seen *E. coli* bacteria is located in the head of the causes of urinary tract infections in Tabriz; the point that is fully consistent with the information available from different sources [1,3,4]. But other bacteria that cause urinary tract infection in Tabriz differ from the bacteria causing these infections in other areas from the prevalence point of view which probably is due to the differences in the epidemiology of Tabriz and other areas. Considering the antibiotic susceptibility of isolated strains; even though these strains are highly vulnerable to ciprofloxacin but due to the side effects of this drug, its utilization can only be done in special cases and by prescription of physicians. Isolates have good sensitivity to third-generation cephalosporin and considering that this group of antibiotics has fewer side effects than ciprofloxacin and gentamicin; therefore it seems more appropriate to use them. Also given that the strains examined in this study showed a less sensitivity to CTM; therefore, use of this drug for treatment of UTI is recommended only by performing antibiogram tests and confirmation of bacterial sensitivity against this drug.In this regard, it seems the indiscriminate use of antibiotics has led to an increase in bacterial resistance against them. Considering the above, it is recommended to start culture experiments and antibiogram tests for the UTI patient immediately after the starting the treatment of urinary tract infections and then continue treatment according to the antibiogram.

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