

# Adoption Rate of Standard Clinical Practice Guidelines in Management of Urinary Tract Infection in a Teaching Hospital of Tehran University of Medical Sciences During Year 2014

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## Abstract

**Background:** Urinary Tract Infection (UTIs) are among the most common infections and inadequate use of the available clinical guidelines leads to the inappropriate usage of antibiotics, which increases drug resistance. The present study aimed to examine the diagnostic methods and treatments for UTI with respect to the available guidelines for a group of patients who were admitted in the internal medicine wards of a teaching hospital.

**Methods:** This was a retrospective descriptive and analytic cross-sectional study on patients with primary UTI admitted in one of the educational hospitals of Tehran University of Medical Sciences during year 2014. After extracting the list of patients from the hospital's archives, the files were checked for relevant data and the questionnaire was completed. The questionnaire in this study was designed based on IDSA (Infectious Diseases Society of America), Johns Hopkins, Sanford School and Mendel. Protocols were screened by the program administrators and examined by the infectious specialists.

**Results:** The analyses showed that the rate of correct treatment was 16.7% and the type of antibiotic was correctly selected in 55.1% of cases. Also, 15.4% of patients received first-line antibiotics, while 39.7% received second-line antibiotics. This study showed 56.4% of patients had structural disorders at admission and proteinuria was the most common structural disorder.

**Conclusion:** our results showed insufficient and inadequate use of the clinical guidelines by the physicians. In that regard, we believe workshops and training courses can improve the outcomes and reduce the costs imposed on the healthcare system.

**Keywords:** Guideline, Teaching Hospitals, Urinary Tract Infections

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## Introduction

Urinary Tract Infection (UTI) is the second most common infection and the most prevalent nosocomial infection. It is also a common cause of antibiotic administration<sup>1</sup>. In general, UTI can be divided into complicated and uncomplicated types with respect to structural and anatomical abnormalities, gender, renal or bladder dysfunction, underlying diseases, diabetes, and catheterization<sup>2,3</sup>. However UTI is more common among younger women due to their anatomical and physiological characteristics; nonetheless, the prevalence becomes similar among males and females from the age of 65 years<sup>2</sup>.

In many cases, in addition to clinical symptoms, laboratory tests are also required to confirm the diagnosis of UTI. Urine analysis is the most common test used in outpatient and inpatient settings for diagnostic purposes. To deal with UTI, the pathogens and their sensitivity should be considered, and then appropriate antibiotics must be prescribed. The type of antibiotic is also determined based on the patient's age, sex, and type of UTI, and then its dosage is adjusted with respect to the renal function<sup>2</sup>.

In various studies, *Escherichia coli* (*E. coli*) has been found to be the most common responsible pathogen for UTI<sup>4</sup>. Inappropriate antibiotic administration for UTI treatment in outpatient facilities is the most common cause of drug resistance in pathogens responsible for UTI, especially *E. coli*<sup>5</sup>. There are guidelines for the treatment of UTI, which provide evidence-based recommendations for physicians to diagnose, treat, and determine the dose and duration of medications. However, in practice, a significant percentage of patients are diagnosed and treated with no adherence to such recommendations<sup>2,4,6-8</sup>. This can increase the treatment failure in patients, affect the expected outcome of treatment, increase the cost of producing and using new antibiotics, and necessitate the use of stronger antibiotics<sup>2</sup>.

In the present study, a questionnaire was used to collect data on therapeutic methods used for patients with UTI, who were admitted to a teaching hospital in Tehran. In order to identify the rate of guidelines adherence and to reduce its incidence, we use the standards of the Infectious Diseases Society of America (IDSA) and Sanford & Mandell in UTI management.

## Materials and Methods

In this descriptive, analytical, cross sectional study, the list of patients with a diagnosis of primary UTI, who were admitted to the internal medicine ward of a teaching hospital in Tehran during year 2014, was extracted from the Hospital Information System (HIS). The medical records of patients were studied to complete the questionnaire.

The questionnaires in this study were filled in similar to that in a study carried out by Iran University of Medical Sciences and then were validated by infectious specialists<sup>6</sup>. The questionnaires were completed by researchers and collected data on demographic characteristics and diagnostic and treatment methods. Accordingly, information about the treatment process including the type, dosage and duration of given antibiotics, was extracted for each patient. Differences and similarities were identified for all 3 parameters according to the table presented by IDSA (2010), guidelines of Johns Hopkins University and Stanford and Mendell's textbook (2010).

## Data analysis

For data analysis, Chi square test and logistic regression analysis were used in SPSS (Statistical Package for the Social Sciences) version 19 to examine the effects of different factors on the compliance of diagnostic measurements and treatments with the guidelines. A p-value below 0.05 was considered statistically significant.

## Results

In this study, patients from the internal medicine wards of the hospital who were diagnosed with UTI were recruited during year 2014. None of the patients was pregnant. Information was extracted from 98 patients, however 20 were excluded due to a positive blood culture. Finally, the study was conducted on 78 patients including 70.5% females and 29.5% males. The mean age of was 68.2±16.1 years, and the highest frequency was attributed to the age ranging from 59 to 81 years (50%). The mean duration of hospitalization was 4.9±7.7 days, ranging from 1 to 22 days.

The mean creatinine level was 1.4±1.85 in patients at admission time and 1.04±1.40 at discharge. The most common clinical and general symptoms including nausea, vomiting, weakness, and anemia, were reported

in 76.9% of patients. Fever and tenderness of the flank, as the most common symptoms were reported in 64.1% and 10.3% of patients, respectively. Also, the most commonly detected organism was *E. coli* (56.5%).

The most frequently used antibiotic was cephalosporins (53.8%), that of them ceftriaxone was at the top of list (Table 1). Results show that 15.4, 39.7 and 44.9% of patients received first-line, second-line, and antibiotics other than those recommended for the intravenous use or a combination of antibiotics, respectively. In addition, the prescribed dose was consistent with the recommended dose in the guidelines for 64.5% of cases. The administered dose was higher than the recommended dose for the type of antibiotic according to the guidelines.

Finally, the duration of treatment was compared with the recommended period in the guidelines and it was inconsistency for 34.6% of cases.

**Table 1.** Distribution frequency of prescribed antibiotics

Antibiotic	Frequency (N)	Frequency (%)
Floroquinolone	30	38.4
Cephalosporins	42	53.8
Carbapenem	35	44.8
Macrolid	2	2.5
Nitrofurantoin	1	1.2
Other	4	5.1

### **Appropriate type of antibiotic and its association with other clinical parameters**

There was no significant difference in terms of choosing the correct type of antibiotic for the age and sex of patients ( $p=0.78$  and  $p=0.066$ ). The relationship between the length of staying in hospital and suitability of antibiotics, and its consistency with the recommended type of antibiotic in the guidelines decreased when the duration of hospitalization increased. Based on the findings, there was congruence with the guidelines in 70.6% of cases with 1-4 days of hospitalization, while in patients with 10-22 days of hospitalization, congruence was only 43.5%; however, this lack of conformity is clinically significant, but not statistically ( $p=0.234$ ). Regarding the association of chronic kidney disease with the suitability of given antibiotic, the non-renal failure group showed higher antibiotic adaptation (64.3% vs. 44.4%;  $p=0.079$ ). Moreover, the relationship between

creatinine clearance and suitability of antibiotic type was in congruence for 36.4% of patients with creatinine levels above 1.5 and 62.5% of patients with creatinine below 1.5; the difference was statistically significant ( $p=0.037$ ). Furthermore, a good congruence was reported between a positive 48-hour urine culture and suitability of given antibiotics and correct antibiotic in 51.9% of cases with a negative urine culture, while the corresponding rate was 25% in those with a positive culture ( $p=0.119$ ).

Appropriate dose of prescribed antibiotics and its association with other clinical parameters The results on the relationship between correct dosage of antibiotic and underlying renal impairment showed that the correct dose was administered in 52.8% of patients with renal impairment, while in patients without impairment, the corresponding rate was 76.2% ( $p=0.03$ ). Analysis of the relationship between proper doses of antibiotic and creatinine level at discharge showed that the correct dose was administered in 45.5% of patients with high creatinine level at discharge and 73.2% of patients with low creatinine level ( $p=0.02$ ).

For the significance of the relationship between baseline renal dysfunction and creatinine level at discharge, the validity of antibiotic dosing was evaluated using logistic regression test to find the odds ratio. The odds ratio for creatinine clearance was 2.16. Findings show that patients with low creatinine clearance received higher doses (2.16 times), compared with patients with high creatinine; however, the difference was not statistically significant ( $p=0.703$ ). In addition, dosage of given antibiotic was 1.77 times higher in patients without renal dysfunction in comparison with those with renal dysfunction ( $p=0.387$ ).

### **Appropriate duration of treatment and its relationship with other parameters**

Evaluation of the relationship between length of hospitalization and duration of treatment within 5 to 9 days after admission, showed that duration of treatment was only appropriate in 28.9% of patients, which was in fact the lowest level of compliance ( $p=0.511$ ). On the other hand, there was no significant relationship between creatinine clearance at discharge and proper duration of treatment.

Analysis of the relationship between clinical symptoms and the suitable duration of treatment showed that the

duration of treatment was appropriate in 60% of patients without fever, while the corresponding rate was 20% in febrile patients, The difference was both clinically and statistically significant. Duration of treatment was improper in all patients with tenderness of the flank, while in 38.6% of patients without tenderness of the flank, duration of treatment was in accordance with the guidelines ( $p=0.03$ ). The duration of treatment was inconsistent with the guidelines in patients with Systemic Inflammatory Response Syndrome (SIRS). In patients without SIRS, the duration of treatment was appropriate in 38% of cases ( $p=0.044$ ).

## Discussion

Patients with clinical signs of UTI and positive urine analysis or culture were enrolled in this study. Twenty patients were excluded from the study because of positive blood culture. Finally, the study was conducted on 78 patients. The mean age of the patients was  $68.2\pm 16.1$  years, and the majority of subjects were within the age range of 59-81 years. Overall, 70.5% of the participants were female, considering that a higher prevalence of UTI occurs among women.

The most commonly cultivated organism was *E. coli* in our study, which is compatible with the literature. In general, 16.7% of patients received appropriate treatment regimens, while the suitability of treatment duration had the lowest consistency with the guidelines (35.6%) and the appropriate dosage of antibiotic was the most consistent parameter among all (65.4%). In a study by Vellinga *et al* from Ireland, the rate of compliance with clinical guidelines for general practitioners was 55%, while 37% of patients received first-line antibiotics<sup>1</sup>.

In their study, the three most commonly prescribed antibiotics were co-amoxiclav, trimethoprim, and fluoroquinolone<sup>1</sup>, while they were cephalosporins, carbapenems, and fluoroquinolones were the most in our study, in that order. In our study, the most commonly used cephalosporin was ceftriaxone (53.8%) and the most common antibiotic mistakenly prescribed was carbapenem, which was given to 35.8% of patients. In our study, 15.4% of patients received first-line antibiotics, while 39.7% received

second-line Antibiotics, while in a study by Martinez and colleagues, 42 and 44% of patients received first- and second-line antibiotics, respectively<sup>3</sup>.

We showed that there was a significant correlation between the choice of appropriate type of antibiotic and creatinine level at discharge ( $p=0.04$ ; odds ratio=2.97). This finding shows that discrepancy in selecting the correct type of antibiotic is 2.97 times higher for patients with creatinine clearance above 1.5, compared to patients with lower creatinine clearance at discharge and we believe that this may be attributable to the fear of further deterioration of renal function or ordering harder treatments for such patients. Based on our findings, 19 out of 22 patients with creatinine level above 1.5 had received combined therapy at discharge.

In the present study, duration of treatment for patients with complicated cystitis (65.2%) was consistent with the guidelines, while the lowest congruence with the recommended duration of treatment in the guidelines happened to the cases of complicated pyelonephritis (19.1%). In patients with complicated cystitis, 42% received the correct regimen, while in patients with complicated pyelonephritis, only one patient had received the correct regimen. In many of these patients, the duration of treatment was not in accordance with the guidelines. In other cases, due to patient deterioration, combination therapy was applied, which is not recommended in the guidelines. Appropriate treatment ( $p=0.6$ ), antibiotic dosage ( $p=0.9$ ), type of antibiotic ( $p=0.2$ ), and treatment duration ( $p=0.5$ ) had no significant relationship with the length of hospitalization or patient's gender.

## Conclusion

The present study was only conducted in the internal medicine wards of a teaching hospital, so we believe that more multicenter and interventional studies are required for a better evaluation of larger-scale medical practices in Iran. According to low Guidelines adherence in UTI treatment, the present study provide an approach to cut down the cost of UTI treatment for the healthcare system. This can also reduce the increasing antibiotic resistance among urinary organisms .

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