

Antibiotic Appropriateness for Urinary Tract Infection in the Emergency Room

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Background: Urinary Tract Infections (UTI) are a common cause of emergency room (ER) visits and antibiotic misuse.

Objective: To evaluate the characteristics of UTI attending ER and to assess antibiotic prescription and inappropriate treatment implications.

Design: A Prospective Study.

Setting: Salmaniya Medical Complex, Bahrain.

Method: Patients aged more than 14 years who presented to the ER with UTI from 1 July 2014 to 31 July 2014 were reviewed. Data was obtained from patients' emergency records and classified according to the type of UTI as complicated, uncomplicated or UTI in pregnancy. Antibiotic treatment was considered appropriate if it followed the Local or International Guidelines.

Result: A total of 239 patients were included in the study; 83 (34.7%) were males, 75 (31.4%) were pregnant females and 81 (33.9%) were non-pregnant females, the mean age was 37.56 years. One hundred forty-five (60.7%) patients had complicated UTI. The most prescribed antibiotics were cefuroxime and ciprofloxacin. Seventy-two (30.1%) of inappropriate antibiotics prescription were mostly due to improper duration.

Inappropriate antibiotic treatment was significantly more common among males, 43 (17.9%) P-value <0.001; complicated UTI were 63 (26.4%), P-value <0.001. One hundred thirty-three (55.6%) prescriptions were written by emergency doctors, P-value <0.001. There was no significance among the different age groups.

Conclusion: High rate of inappropriate antibiotics use in UTI patients mostly in complicated UTI and in patients treated by emergency doctors physicians.

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Urinary tract infections are estimated to account for one million emergency department visits annually¹. The prevalence of antibiotic-resistant pathogens causing UTI is increasing; therefore, it is essential to use the most suitable antimicrobial in UTI treatment.

Principally, it is fundamental to avoid critically important antimicrobials, such as quinolones, third generation cephalosporin, etc that provoke antimicrobial resistance².

The chief medical officers' annual reports of 2011 emphasized the concept of antimicrobial supervision, which promotes the idea of avoiding the use of unnecessary and improper

antimicrobials to reduce the emergence of antibiotic-resistant organisms³.

If infection is caused by antibiotic-resistant pathogens, treatment failure, long hospital stay, rising cost and mortality are expected. Because the majority of urine samples tend to grow organisms of no clinical significance, the diagnosis of UTI must be based on clinical symptoms and signs rather than microbiology results; bacteriuria is not an infection^{6,7}. Although many guidelines indicate that the culture of urine is not required in most cases of uncomplicated UTI, our hospital accepts all culture requests for all emergency patients. Urinary tract infections are predominantly caused by Escherichia coli

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and are treated empirically prior to the results of antibiotic susceptibility testing^{6,8,9}.

To our knowledge, there are few published studies assessing the appropriateness of antibiotics prescription for UTI in the emergency department worldwide and most of the regional studies were about the predominant pathogens and pattern of antibiotics prescriptions^{8,10-12}.

The aim of this study is to evaluate the characteristics of UTI attending ER and to assess antibiotic prescription and inappropriate treatment implications.

METHOD

A study was performed from 1 July 2014 to 31 July 2014; patients diagnosed with UTI aged more than or equal to 14 years were reviewed. Two hundred and thirty-nine patients' records were reviewed. A form was designed by the research team and was filled accordingly.

The form included the following information: vital signs, clinical signs and symptoms, laboratory and radiological investigations, complete blood count, urea and creatinine values, urine sample analysis and urine culture, prescribed antibiotics, dose and duration, prescribing physician specialty, age, sex and pregnancy status.

No attempt was made to verify the accuracy of the physicians' diagnosis because the aim was to assess the physicians' prescribed antibiotic appropriateness in the ER Department. Urine analysis with WBC count of 10^5 per colony or more was considered positive.

UTI is classified as complicated and uncomplicated. Uncomplicated UTI is defined as acute cystitis and pyelonephritis developing in a healthy, immunocompetent and non-pregnant female who has no abnormal urinary tract anatomy or function. Otherwise, the UTI is categorized as complicated¹³.

The following classification of appropriateness was used: appropriate, inappropriate due to improper antibiotic choice, dosage, duration or route.

Each case was reviewed by two investigators to define the type of UTI and assess the appropriateness of antibiotic therapy. The antibiotics therapy was reviewed to assure compliance with the recommendation of the Local Guidelines of the Infectious Disease Department at the Ministry of Health, June 2013, Stanford and IDSA guidelines^{14,15,16}.

The CDC-EPI Info program version 7 was used for data entry and analysis. Frequencies and percentages were used to present qualitative variables. Cross-tabulation was used to figure the relationship between any two qualitative variables. To test the significance between two qualitative variables, a Chi-squared test was used. Any P-value below 0.05 was considered significant.

RESULT

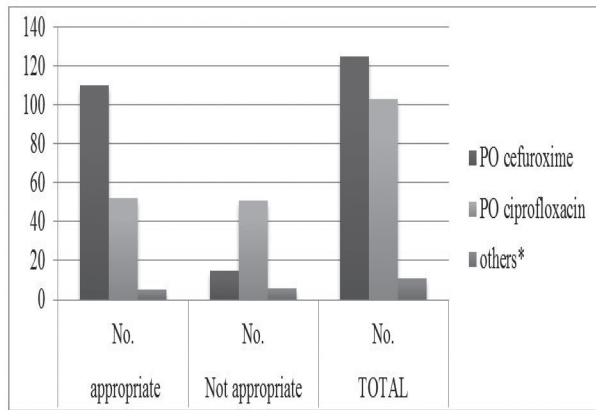
Two hundred thirty-nine patients were diagnosed with Urinary Tract Infection: 19 (7.9%) had uncomplicated UTI, 145 (60.7%) had complicated urinary tract infection (83 were males and 62 were non-pregnant female); 75 (31.4%) were urinary tract infection in pregnancy. The mean age was 37.56 years, 157 (65.7%) patients were between 19-39 years old, 71 (29.7%) were pregnant females, 46 (19.2%) non-pregnant females and 40 (16.7%) were males, see table 1.

Urine analysis was performed on 203 (85%) patients and 144 (60.3%) of those yielded an abnormality consistent with urinary tract infection. However, only 74 (40%) patients had a urine culture performed and 15 (20.3%) of those were positive.

The most frequently prescribed antibiotic was oral cefuroxime (n=125, 52.3%), 110 (46%) were prescribed appropriately and ciprofloxacin (n=103, 43%), 50 (20.9%) were prescribed appropriately. Three (1.3%) patients received intravenous antibiotics without following oral course and were considered inappropriate. The frequency of antibiotics prescribed and their appropriateness is shown in figure 1.

Table 1: Patients Personal and Clinical Characteristics

Characteristics	Female				Male		TOTAL		
	Pregnant		Non-pregnant		No.	%	No.	%	
	No.	%	No.	%					
Age	<=18	1	1.3%	6	7.4%	3	3.6%	10	4.2%
	19-39	71	94.7%	46	56.8%	40	48.2%	157	65.7%
	40-60	3	4.0%	15	18.5%	24	28.9%	42	17.6%
	>60	0	0.0	14	17.3%	16	19.3%	30	12.6%
	TOTAL	75	100%	81	100%	83	100%	239	100%
Nationality	Bahraini	72	96.0%	71	87.7%	60	72.3%	203	84.9%
	Non Bahraini	3	4.0%	10	12.3%	23	27.7%	36	15.1%
	TOTAL	75	100%	81	100%	83	100%	239	100%
Type of UTI	Complicated	0	0.0	62	76.5%	83	100%	145	60.7%
	Uncomplicated	0	0.0	19	23.5%	0	0.0	19	7.9%
	Pregnant	75	100	0	0.0	0	0.0	75	31.4%
	TOTAL	75	100%	81	100%	83	100%	239	100%



Others*: PO amoxicillin-clavulante, PO cephalixin, nitrofurantoin, trimethoprim-sulphamethoxazole, IV cefuroxime, IV ceftriaxone

Figure 1: Frequency of Antibiotics Used and Their Appropriateness

Obstetrics and gynecology physicians prescribed antibiotics to all pregnant female (n=75) and 20 non-pregnant females. One hundred thirty-three patients (male 77, non-pregnant female 56) were prescribed antibiotic by emergency physicians. Eleven patients (male n= 6, non-pregnant female n= 5) were prescribed by surgical physicians.

Antibiotics were used inappropriately in 72 patients (30.1%). Most common cause of inappropriateness was due to improper duration (n= 62, 26.27%). Inappropriateness due to dose was seen in 11 (4.66%) patients, see table 2 and 3.

Table 2: Reasons for Appropriate and Inappropriate Use of Antibiotic

Reasons of Inappropriateness*	Number	Percentage	
			Appropriate
Choice of antibiotic	236	69.87	
	3	30.13	
	239	100	
Dose**	225	95.33	
	11	4.66	
	236	100	
Duration**	174	73.73	
	62	26.27	
	236	100	

* More than one reason may apply to each prescription.

** Prescriptions with appropriate antibiotic choice.

All pregnant females received appropriate antibiotic (proper choice, dose and duration) compared to 58% non-pregnant females and 48.2% males, which is statistically significant (P-value= <.001). P-value was significant in inappropriateness due to duration being used less appropriately among male (n= 62, 26.3%), and the dose being less appropriately among non-pregnant females (n= 9, 11.3%).

Chi-squared P-value showed that there is a significant statistical difference in appropriateness regarding gender and type of UTI. There was no statistical significance in appropriateness among the different age group, see table 4.

Table 3: Appropriateness and Inappropriateness of Antibiotics Treatment

Antibiotic Prescription	Female				Male		Total		P-value	
	Pregnant		Non-Pregnant		No.	%	No.	%		
	No.	%	No.	%						
Full Appropriateness	Appropriate	75	100	52	58.0	40	48.2	167	67.8	0.001
	Inappropriate	0	0.0	29	44.5	43	33.6	72	29.7	
	TOTAL	75	100	81	100	83	100	239	100	
Appropriate Choice	Appropriate	75	100	80	98.8	81	97.6	236	98.7	0.3973
	Inappropriate	0	0.0	1	1.2	2	2.4	3	1.3	
	TOTAL	75	100	80	99	81	98	236	99	
Appropriate Dose	Appropriate	75	100.0	71	88.8	79	97.5	225	95.3	0.0021
	Inappropriate	0	0.0	9	11.3	2	2.5	11	4.7	
	TOTAL	75	100	80	100	81	100	236	100	
Appropriate Duration	Appropriate	75	100.0	57	71.3	42	51.9	174	73.7	0.001
	Inappropriate	0	0.0	23	28.8	39	48.1	62	26.3	
	TOTAL	75	100	80	100	81	100	236	100	

Table 4: Appropriateness in Relation to Gender, Age and Type of UTI

Characteristics No.	Appropriate		Not Appropriate		Total		P-value	
	%	No.	%	No.	%	No.		
Gender	Female	52	31.1	29	40.3	81	33.9	0.001
	Male	40	24.0	43	59.7	83	34.7	
	Pregnant	75	44.9	0	0.0	75	31.4	
	Total	167	100	72	100	239	100	
Age	≤18	7	4.2	3	4.2	10	4.2	0.0343
	19-39	119	71.3	38	52.8	157	65.7	
	40-60	25	15.0	17	23.6	42	17.6	
	>60	16	9.6	14	19.4	30	12.6	
	Total	167	100	72	100	239	100	
Type of UTI	Complicated	82	49.1	63	87.5	145	60.7	0.001
	Uncomplicated	10	6.0	9	12.5	19	7.9	
	Pregnant	75	44.9	0	0.0	75	31.4	
	Total	167	100	72	100	239	100	

DISCUSSION

Our study found poor adherence to the current local and international recommendation for the management of complicated and uncomplicated types of UTI, while it showed 100% adherence to treatment in pregnancy. Similar studies showed different outcomes. In Taiwan, a study showed inappropriateness rate of 27.9%, in Spain 20.5%, France 80%, United States 66.1% and Ireland 45%^{10,17-20}.

Despite the worldwide higher prevalence of UTIs in females compared to males in ages less than 60-year-old, our study found a high prevalence of UTI in males compared to females in this age group, which might be caused by under-diagnosed urinary tract anatomical abnormalities, Sexually Transmitted Diseases or prostatitis²¹⁻²².

The majority of the patients who attended the ER had complicated UTI. In our study, ciprofloxacin and cefuroxime were widely used to treat complicated and uncomplicated UTI. Ciprofloxacin was the most commonly used, as well as in the United States emergency rooms²³⁻²⁵. Fluoroquinolones are broad-spectrum and have good tissue penetration and thus the drug of choice for empiric treatment of uncomplicated and complicated UTIs but collateral damage and subsequent risk of infection with MRSA and increase drug resistance in gram-negative bacilli infection has made this class of antibiotics less useful than in the past²⁶⁻²⁹.

In Ireland, amoxicillin-clavulanate was preferred over ciprofloxacin 33% and 17% respectively¹⁰.

In pregnancy, our staff uses second-generation cephalosporin (cefuroxime) for its efficacy and safety in pregnancy. A study of UTI in pregnancy showed wide use of cephalosporins and amoxicillin³⁰.

We observed that trimethoprim-sulfamethoxazole and nitrofurantoin were not the preferred agents for the treatment of uncomplicated UTI despite the recommendations as first line treatment in the local and international guidelines. A study

showed the underuse of trimethoprim-sulphamethoxazole and nitrofurantoin for UTI³¹.

Short course regimen for the treatment of uncomplicated cystitis is recommended as the first-line therapy and is as effective as longer antibiotics regimens in achieving symptomatic cure with fewer side-effects. On the other hand, long duration is needed for the treatment of uncomplicated and complicated UTI. In our study, improper duration was a major cause of inappropriateness, especially among males. Sigler et al showed that treatment duration for complicated and uncomplicated had the lowest frequency of appropriateness, 71.9% and 58.6% respectively¹¹.

Urine cultures are not needed for uncomplicated UTI, while it is recommended for complicated UTI and in pregnancy to tailor the treatment accordingly; in our hospital it was not requested as indicated, this may resulted in suboptimal treatment.

Our quality evaluation showed that the rate of inappropriate prescription of antibiotics was higher among emergency doctors rather than other specialties.

The local pattern of antibiotic resistance must be taken into consideration before prescribing antibiotic to a patient. In addition, the patient's co-morbid history must be considered to avoid unwanted side-effects.

The goal of antibiotic stewardship program is to choose the right antibiotic genera, the proper dose and shortest duration of therapy.

Most of the reasons could be addressed and overcome by a well-structured educational program for the ER to minimize the inappropriate prescription of antibiotics and subsequently the rate of the resistant organisms.

No data recorded about recurrence of UTI and no data about previous antibiotics use. Our study was based on the evaluation of the ER records of the patients not on the clinical evaluation of the patients.

CONCLUSION

The majority of patients who presented to our emergency department had complicated UTI.

Our results revealed a high level of inappropriate use of antibiotics in the ER. It is the responsibility of all healthcare workers to practice antibiotic stewardship and prescribe antibiotics wisely and rationally in order to minimize the inappropriate prescription of antibiotics and subsequently the rate of resistant organism. It is the time to incorporate ER department in the antibiotic stewardship program in our hospital policies. There should be a full structured educational program for ER physicians to ensure better compliance with the local and international guidelines.

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(2) drafting the article and revising it critically for important intellectual content; and (3) final approval of the manuscript version to be published. Yes.

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