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Patterns of antibiotic prescriptions and appropriateness in the emergency room in a major secondary care hospital in Bahrain

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Abstract

Objective: To describe the pattern and appropriateness of antibiotics prescribed in the emergency room in a major secondary care hospital in Bahrain.

Methods: Patients aged more than or equal to 14 years old that attended emergency room and was prescribed antibiotics from 1 to 31 July 2014 were included. Data were obtained from patients' emergency records. Antibiotic treatment was classified to appropriate, inappropriate or unjustified use according to the local or international guidelines. Chi Square was performed to evaluate the variables associated to appropriateness antibiotic treatment.

Results: A total of 1313 patients were included (52.6% males), mostly in the age group 14-30 years old (45.3%). The most frequent diseases attended were upper respiratory and urinary tract infections (27.3% and 22.1%,respectively). Cefuroxime was the most prescribed antibiotic (37.5%) followed by ciprofloxacin (20.8%). Percentage of inappropriate antibiotics prescription was 81.9% mostly due to unjustified use. Inappropriate antibiotic treatment was significantly more common in males (87.1%; P-value <0.001), in patients without mentioned diagnosis, then upper respiratory tract infection (100%, 96.9%. P-value <0.001) and prescriptions written by emergency physicians (85.5%; P- value <0.001).

Conclusion: The study concludes that high rate of inappropriate antibiotics use mostly among patients treated by emergency doctors.

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Key words: Antibiotics appropriateness, pattern, Antibiotic guidelines, emergency department.

Introduction

Antibiotic resistance is a mounting public health concern [1], therefore it is important to preserve the effectiveness of presenting available antibiotic for future generations [2]. Antibiotic resistance was most commonly found in prescribed drug in several national and international studies [3].

The united states' chief medical officers annual reports of 2011, promoted the concepts of antimicrobial stewardship, which means that unnecessary or inappropriate use of antibiotics, should be avoided to minimize the selection of antibiotic resistant organisms [4]. In addition, the overuse of antibiotic drugs can lead to unnecessary side effects [5,6,7]. An estimated 142,500 visits were recorded to United States emergency departments each year because of adverse events associated with use of systemic antibiotics; approximately 80% due to allergic reactions [5,6].

Studies on antibiotic appropriateness in emergency department settings are very limited and largely focused on in-patients and pediatrics age groups [8,9,10].

There are many challenges associated with providing a systematic review for proper antibiotic prescription in emergency departments. These include rapid patients turn over, high rate of examined patients in emergency department [11], failure to reach final diagnosis and the physicians desire to maintain patient's satisfaction.

The aim of this study was to evaluate the patterns and appropriateness of antibiotics prescription, and to apply the stewardship program in emergency room in Salmaniya Medical Complex.

Methods and population

This is a prospective observational study included data collected on a daily basis from patients attending the accident and emergency room over a one-month period, from 1 to 31 July 2015.

The study was conducted in Salmaniya Medical Complex emergency room, which is the main secondary hospital in the Kingdom of Bahrain. The emergency room in the hospital examine an average 1000 patients per day. All Patients aged ≥14 years old and who were prescribed antibiotics in the emergency room were included in the study. A total of 1313 patient's emergency room records were reviewed by the researchers. This study was approved by the research committee of the Ministry of Health in Bahrain

Data collection

A form was designed by the research team and were filled accordingly. The form included the following demographic data: sex, age, pregnancy status and nationality, vital signs, physical signs and symptoms, presenting system, laboratory and radiological investigations, antibiotic prescribed with their doses and duration, frequency and route, physician specialty and final diagnosis by the attending physician. No attempt was made to verify the accuracy of the physician diagnosis because the aim was to assess the physicians attitudes in prescribing antibiotic appropriateness in the emergency department. The antibiotic therapy was reviewed by each researcher to assure compliance with the recommendation of the local guidelines of infectious disease department at Ministry of Health in Bahrain [12] or the IDSA guidelines [13].

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The following classification was used: Appropriate or inappropriate. The appropriate use was defined as proper antibiotic choice, dose, frequency, duration, route and combination. The inappropriate use was defined as improper antibiotic choice, dose, frequency, duration or route, improper combination or unjustified use. Patients who received antibiotics without mentioned diagnosis were considered inappropriate and unjustified use of antibiotics.

Statistical analysis

The statistical package for social science (SPSS) program version 21 was used for data entry and analysis. Frequencies and percentages were used to present qualitative variables. Also cross-tabulation was used to present the relationship between two qualitative variables. Chi- squared test was used to test whether there is a significant relationship between two categorical variables. P value < 0.05 was considered statistically significant.

Table1. Demographical data (*n* = 1313)

Characteristics		N	%
Gender	Male	690	52.6
	Female	623	47.4
	Total	**1313**	**100**
Pregnancy	Yes	151	24.2
	No	472	75.8
	Total	**623**	**100**
Age group in years	14-30	595	45.3
	31-40	340	25.9
	41-50	154	11.7
	51-60	109	8.3
	>60	115	8.8
	Total	**1313**	**100**
Nationality	Bahraini	1224	93.2
	Non Bahraini	89	6.8
	Total	**1313**	**100**

Results

The demographic characteristics of the patients are shown in **Table 1**. There were 690 males (52.6%), of these 595 (45.3%) belonged to age group 14-30-year, there was no statistical significance difference among the different age groups or the nationality and the vast majority were Bahraini (n = 1224; 93.2%) as shown in **Table 1**. Culture specimens were requested from part of the patients as followed: Urine cultures (n = 113; 8.6%), blood cultures (n = 32; 2.4%), wound swabs (n = 31; 2.36%) and vaginal swabs (n = 26; 1.98%). The results of cultures showed bacterial growth in 20%, 4%, 10%, 12%, respectively. Most patients were diagnosed with diseases of upper respiratory tract system (n = 358; 27.3%), followed by renal system (n = 290; 22.1%) and skin and soft tissue (n = 249;19.0%), genital tract (n = 51, 4%), lower respiratory tract infection (n = 30, 2%), musculoskeletal system (n = 26, 2%) and others (n = 27, 2%), while 118 (100.0%) were prescribed antimicrobials without clinical diagnosis as shown in **Table 2**. Emergency physicians wrote most of the prescriptions (n = 1031; 78.5%), compared with other specialties including: obstetrics and gynecologist (n = 196; 14.9%), surgeons (n = 43;3.3%), internist (n = 15; 1.1%) and other specialties (n = 28; 2.1%) as demonstrated in **Table 2**. Chi squared p value showed a high significant difference in appropriateness percentage between different presenting systems and prescribed specialties. Inappropriateness was more in those without mentioned diagnosis (n = 118, 100%) followed by upper respiratory tract system (n = 347; 96.9%) as shown in **Table 2**. Emergency physicians dominate the most inappropriate prescriptions (n = 881; 85.5%, *P*-value <0.001) **(Table 2)**.

Out of 8358 patients visited the emergency department in July 2014, 1313 (7.2%) were prescribed antibiotics. The most frequently prescribed antibiotics were cefuroxime (n = 492; 37.5%), ciprofloxacin (n = 273; 20.8%) and amoxicillin-

Table 2. Appropriateness in relation to the involved body sites and the prescribing physician's specialty

Variable	Appropriate				P-value
	Yes		No		
	No.	%	No.	%	
System					
Upper respiratory tract	11	3.1	347	96.9	<0.001
Urinary tract	110	37.9	180	62.1	
Skin & soft tissue	63	25.3	186	74.7	
Gastrointestinal tract	24	17.5	113	82.5	
No mentioned diagnosis	0	00.0	118	100.0	
Genital tract	4	7.8	47	92.2	
Lower respiratory tract	13	43.3	17	56.7	
Maxillofacial and oral	5	18.5	22	81.5	
Musculoskeletal	6	23.1	20	76.9	
Others[a]	1	3.7	26	96.3	
Prescribing physician's specialty					
Emergency	150	14.5	881	85.5	<0.001
Obstetrics and Gynecology	62	31.6	134	68.4	
General Surgery	11	25.6	32	74.4	
Internal Medicine	7	46.7	8	53.3	
Other specialties[b]	7	25.0	21	75.0	

[a] Including: Ophthalmology, central nervous system, hematology, oncology and infectious disease.
[b] Including: Ear, nose and throat, orthopedic, plastic, maxillofacial and oral, urology, neurology.

clavulanic acid (n = 193; 14.7%), followed by others antibiotics are shown in **Table 3**. A total 0f 112 patients received single intravenous antibiotic dose only and without additional oral antibiotic course. Another 46 patients received ceftriaxone, followed by cefuroxime (n = 39), metronidazole (n = 26) and meropenem (n = 1).

Chi squared p value showed a high significant difference in appropriateness percentage between different presenting infections and prescribed medical specialties. Inappropriateness was more in those without mentioned diagnosis (n = 118; 100%) followed by upper respiratory tract infection (n = 347; 96.9%) . Antibiotic therapy was found to be inappropriate in 1076 prescriptions (81.9%) of the total prescriptions (1313). The most common cause for inappropriateness was the unjustified use (n = 476; 36.3%) as demonstrated in **Table 4**. Chi-squared p value showed that there is a high statistical significant difference in appropriateness percentage between males and females; antibiotics were used less inappropriately among females (n = 475; 76.2%) than male (n = 601; 87.1%) **(Table 4)**. Appropriate and inappropriateness of chemotherapy to each used antimicrobial drug is shown in **Table 5**.

Discussion

The major finding of this study was the presence of high levels of inappropriate use of antibiotics. Although the principals of antibiotic prescriptions have been well established internationally for many years, their inappropriate use is still common

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Table 3. Frequency and percentages of various antibiotics prescribed in the emergency department[a]

Antimicrobial prescribed	No.	%
Cefuroxime	492	37.5
Ciprofloxacin	273	20.8
Cephalexin	126	9.6
Amoxicillin/clavulanate acid	193	14.7
Metronidazole	101	7.7
Amoxicillin	57	4.3
Clarithromycin	18	1.4
Erythromycin	9	0.7
Cloxacillin	12	0.9
Doxycycline	9	0.7
Nitrofuranton	2	0.2
Norfloxacin	1	0.1
Trimethoprim-sulfamethaxazole	1	0.1
Trimethoprim-sulfamethaxazole DS	1	0.1

[a] Some of the patients used more than one antibiotic.

especially in the developing countries[15,16]. The study also revealed that the antibiotic prescription rate in the emergency room is 7.2%, which is low compared to other countries in our region, while such rate was 61.9% in Iran [17], 60.7% in England [18], 48% in Norway [19] and 46% in Saudi Arabia [20].

It has been reported that penicillin and flouroquinolones were the most frequently prescribed antibiotics in several studies in the developed and developing countries [16,21-22].

In this study cephalosporins, specifically cefuroxime was the most prescribed antibiotic, because of their broad spectrum of activity, clinical efficacy, availability and favorable tolerability profiles. However, penicillin was much less prescribed compared with other countries despite their availability. The flouroquinolones were also less prescribed than in other studies because use of these antibiotics are restricted by the antibiotic policy of hospital. Similar findings were found in a

Table 4. Appropriateness in relation to demographical data (*n* = 1313)

Characteristics	Appropriate		Inappropriate		P-value
	No.	%	No.	%	
Gender					
Male	89	12.9	601	87.1	<0.001
Female	148	23.8	475	76.2	
Age group in years					
14-30	108	18.2	487	81.8	0.806
31-40	57	16.8	283	83.2	
41-50	27	17.5	127	82.5	
51-60	19	17.4	90	82.6	
>60	26	22.6	89	77.4	
Nationality					
Bahraini	220	18.0	1004	82.0	0.997
Non Bahrainis	17	19.1	72	80.9	

Table 5. Appropriate and inappropriateness of antibiotic therapy.

Antimicrobial	appropriate		inappropriate								Total
			total		inappropriate choice		Not indicated		Wrong combination		
	n	%	n	%	n	%	n	%	n	%	
Cephalexin	80	63.49	46	36.51	14	11.11	31	24.60	1	0.79	126
Ciprofloxacin	134	49.08	139	50.92	25	9.16	101	37.00	13	4.76	273
Metronidazole	16	15.84	85	84.16	15	14.85	59	58.42	11	10.89	101
clarithromycin	11	61.11	7	38.89	1	5.56	2	11.11	4	22.22	18
Erythromycin	1	11.11	8	88.89	2	22.22	2	22.22	4	44.44	9
Amoxicillin	36	63.16	21	36.84	0	0.00	21	36.84	0	0.00	57
Cefuroxime	273	55.49	219	44.51	53	10.77	156	31.71	10	2.03	492
Amoxicillin/ clavulanate	125	64.77	68	35.23	15	7.77	51	26.42	2	1.04	193
Cloxacillin	7	58.33	5	41.67	2	16.67	3	25.00	0	0.00	12
Doxycycline	3	33.33	6	66.67	1	11.11	2	22.22	3	33.33	9
Nitrofuranton	0	0.00	2	100.00	1	50.00	1	50.00	0	0.00	2
Norfloxacin	0	0.00	1	100.00	0	0.00	1	100.00	0	0.00	1
Trimethoprim/ sulphamethaxazole	0	0.00	1	100.00	0	0.00	1	100.00	0	0.00	1
Trimethoprim/ sulphamethaxazole DS	1	100.00	0	0.00	0	0.00	0	0.00	0	0.00	1

study done in Bangladesh, where cephalosporines were used in 31.78% of all prescriptions and followed the use of macrolides (27.33%) [23]. A study in France showed cephalosporines were used in 21% and flouroquinolones in 22% in treatment of the patients, respectively, while penicillins used in 43% [24]. Amoxicillin-clavulanate was used in 30% of the patients in Saudi Arabia [20], while its use reached 54% in Spain [25]. A study performed in the United States reported that azithromycin was the mostly prescribed antibiotic for outpatients[26].

This study indicated that emergency doctors in our hospital have misused intravenous administration of antibiotics in patients without clearly indication for their need. Inappropriate intravenous therapy increases the cost of care and also exposes the patients to the risk of infection associated with intravenous catheters [27].

Overall our study found that antibiotic therapy was inappropriate in 80.9% of the examined patients, despite the accessibility of the antibiotic guidelines in the emergency rooms in form of booklets and on the internet. However, our results show antibiotics inappropriateness rate was much lower than in studies done in other countries, including Australia [28], Spain [25], France [29] 48.6%, 43%, 31%, respectively.

The high rate of the inappropriate use of antibiotics

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in our study was mostly due to unjustified use and the wrong duration of treatment. In Spain similar results were obtained from a study found that 40% of patients were prescribed antibiotics without justified cause [25]. Another study in Spain showed most cause of inappropriateness is due to improper duration of treatment (39.9%) [21]. A study in the Saudi Arabia showed that the duration of treatment was the most common cause of inappropriateness [30].

The present study shows that the burden of respiratory symptoms / conditions in our emergency department was large, and there was marked misuse in antimicrobial prescriptions.

Our quality evaluation showed that the rate of inappropriate prescription of antibiotics were higher among the emergency room doctors than other medical specialties. Antimicrobial therapy should be tailored to each patient taking into consideration the presenting signs and symptoms, the local patterns of antimicrobial resistance and the potential for collateral damage associated with antimicrobial use. Selecting the correct drug, dose, and shortest clinically effective duration of therapy are important keys to optimal antimicrobial stewardship. Most of the obstacles could be addressed and controlled by implementing a well-structured program for the emergency department in order to minimize the inappropriate prescription of antibiotics and, subsequently to control the rate of developing antimicrobial resistant organisms.

There are some limitations of this study: First, the level of the antibiotic use could not be accurately measured due to the absence of accurate medication charts and the poor quality of medication record-keeping in the emergency department. Second, our study was based on the evaluation of the emergency record of the patients and not based on the clinical evaluation of the patients. It is the responsibility of all healthcare providers to practice antimicrobial stewardship and prescribe antimicrobials wisely and rationally in order to minimize the inappropriate prescription of antibiotics and subsequently the rate of the resistant organisms. It is time to incorporate emergency department in the antibiotic stewardship program in our hospital policies. There is also a great full structured educational program available for the emergency room physicians and other specialty doctors to ensure better compliance with the local and international guidelines.

In conclusion, our results revealed a significantly high level of the inappropriate use of antibiotics in the emergency department in Salmaniya Medical Complex, being highest among emergency doctors. Cefuroxime was the most prescribed antibiotic followed by ciprofloxacin. Most common cause of inappropriateness is the unjustified use and improper duration of antibiotic treatment.

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