



Evaluation of the status of antibiotic prescription in patients admitted to a teaching hospital in west of Iran

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Original Article

Abstract

BACKGROUND: The aim of this study was to evaluate the status of the appropriate use of antibiotics by type, dosage, and length of treatment and the route of administration in Tohid teaching hospital, Sanandaj, Iran.

METHODS: In a retrospective descriptive study, 400 patients were systematically selected from patients receiving antibiotics hospitalized in Tohid hospital from March 2016 to March 2017. Demographic characteristics, hospitalization ward, diagnosis, antibiotic prescribed, dosage, length of treatment, the route of administration, and prescribing physician were recorded. The treatments were compared with standard treatment based on Harrison reference. The data were analyzed using STATA software.

RESULTS: Out of total patients, 54% were men and 46% were women with a mean age of 57.87 ± 9.87 years. The mean duration of hospitalization was 6.37 ± 2.69 days. More and less numbers of patients were admitted in the internal medicine ward (23.75%) and intensive care unit (ICU) (1.00%), respectively. The highest antibiotics were administered by internal medicine specialists (40.25%), the most commonly prescribed antibiotic was ceftriaxone (34.59%), and the most common cause of antibiotic therapy was pneumonia (20.50%). Out of 595 antibiotics prescribed, 28.50% of the administrations were inappropriate. In addition, the objective for the prescription of the first and second antibiotic was inappropriate in 27.50% and 33.70% of cases, respectively. Dosage, route of administration, and the length of treatment of the prescribed antibiotic was inappropriate in 9.00%, 0.50%, and 41.00% of cases, respectively. The highest and lowest rate of inappropriate antibiotic prescription was observed in surgical (51.31%) and infectious diseases (12.90%) wards.

CONCLUSION: Due to the increase inappropriate administration of antibiotics, it is necessary to train the specialists about the planning, appropriate medical consultations for antibiotic therapy, and limitation of the new antibiotics prescription.

KEYWORDS: Antibiotic, Prescription, Patients

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Introduction

Antibiotics are of the important advances

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made by the modern medicine, and proper use of them has resulted in a significant reduction in mortality.¹ Patients who are hospitalized in the new era are older than the patients hospitalized a decade ago, and have a poorer immunity status which makes them more

susceptible to bacterial infections; thus they are more in need of antibiotics.^{1,2} The use of antibiotics in hospitals is increasing.³ Antibiotics are the second most commonly used drugs in the America and Europe, and 60-90% of hospitalized patients receive antibiotics while 40% of these cases have no proper laboratory confirmation and indications. Inappropriate prescription is more common in surgical wards than in medical wards.^{4,5} According to Amane and Kop study, 75% of cases of antibiotic prescription in the surgical ward were inappropriate.⁶

Antibiotics are the most common type of drug purchased and used by patients in developing countries, and 44-97% of the patients receive antibiotics while a considerable part of these prescriptions are unnecessary and inappropriate; these countries have poor control over the use of antibiotics.^{7,8} According to some studies, the use of antibiotics have increased by 40% over few years.⁹ Studies have shown that the use of antibiotics in Iran is about 2-4 times more than that in European and American countries; the majority of inappropriate antibiotics are prescribed for treating upper respiratory tract infections.^{8,10} Inappropriate antibiotic prescription mainly includes inappropriate combination therapy, inappropriate dosage of medication, inappropriate duration of treatment, inappropriate antibiotic prophylaxis, inadequate tissue penetration of prescribed antibiotic, drug interactions, and inappropriate pattern of prescription. Inappropriate and excessive prescription of antibiotics is associated with increased drug resistance and the emergence of multi-drug resistant (MDR) organisms.¹⁰

Given the above-mentioned facts, nowadays the antibiotic-resistant nosocomial infections have become a global concern; because they are associated with increased mortality, increased length of hospital stay, increased costs, increased need for expensive antibiotics, and increased use

of protective equipment such as gown and gloves.^{3,11} The aim of this study was to evaluate the status of appropriate use of antibiotics by type, dosage, length of treatment and the route of administration in Tohid teaching hospital, Sanandaj, Iran.

Materials and Methods

This retrospective descriptive study carried out on patients hospitalized in the Tohid teaching hospital from March 2016 to March 2017, who were under antibiotic therapy. Study protocol was approved by the Ethics Committee of Kurdistan University of Medical Sciences, Iran. Based on the principles of Helsinki Declaration, all aspects of protecting personal data of the participants were considered by the researchers.

Systematic random sampling was done and considering a ratio of 50% for each dependent variable, and confidence interval of 5%, 400 patients with a history of at least one antibiotic intake presenting to the mentioned hospital, were included. No age limitation was set for the participants. Patients with incomplete medical profiles, unavailable data, and unknown history were excluded.

With the aid of a pre-designed checklist, demographic data, and baseline characteristics (hospitalization ward, diagnosis, Duration of hospitalization, antibiotic prescribed, and physician) of the patients were obtained from the patient medical records. Outcome measures of inappropriate antibiotic prescribing were determined based on the type of drug, dosage, route of administration, and length of treatment by the physician depending on the disease, severity of the disease, and conditions of the patient. All of data were gathered by a medical student; then, the extracted data were reviewed by three infectious disease specialists. The treatments were compared with standard treatment based on Harrison's textbook.¹²

Finally, the extracted data were entered into Stata software (Version 11, StataCorp, College

Station, TX, USA) and were analyzed using descriptive statistics. In addition, the results were presented in tables and the percentages and confidence intervals were calculated.

Results

The mean age of the patients was 57.70 ± 9.87 years, and the mean duration of hospitalization was 6.37 ± 2.69 days.

More and less numbers of the patients were admitted to internal medicine ward (23.75%) and intensive care unit (ICU) (1.00%), respectively. The highest number of antibiotics was prescribed by specialists (42.75%); in addition, internal medicine specialists were the largest group of specialists prescribing antibiotics (40.25%). Pneumonia was the most common diagnosed condition which led to antibiotic prescription (20.50%), and diabetic foot ulcer and cellulitis were the least common infectious diseases which led to antibiotic prescription (1.00%) (Table1).

The most commonly used antibiotics were ceftriaxone (34.59%) and ciprofloxacin (23.06%), respectively (Table 2).

28.50% of the total 678 cases of antibiotics prescribed for treatment and prophylaxis were inappropriate. The objective for the prescription of the first and second antibiotic was inappropriate in 27.50%, and 33.70% of cases, respectively. The dosage, route of administration, and the length of treatment of the prescribed antibiotic was inappropriate in 9.00%, 0.50%, and 41.00% of cases, respectively. The highest and lowest rate of inappropriate antibiotic prescription was observed in surgical (51.31%) and infectious diseases (12.90%) wards, respectively (Table 3).

Discussion

Inappropriate prescription of antibiotics (in terms of dosage, duration, and type of medication) can increase health care costs, complications, length of hospital stay, and the incidence of drug resistance.¹³⁻¹⁵

Table 1. Number of patients receiving antibiotics, by ward, physician admitting, and diagnosis of the disease

Variable		Frequency (%)	
Ward	Intensive care unit (ICU)	4 (1.00)	
	Internal	95 (23.75)	
	Infectious diseases	31 (7.75)	
	Heart diseases	72 (18.00)	
	Neurology	24 (6.00)	
	Gastrointestinal diseases	30 (7.50)	
	pulmonary diseases	34 (8.50)	
	Oncology	37 (9.25)	
	Surgery	33 (8.25)	
	Urology	40 (10.00)	
	Physician	General practitioner	3 (0.75)
Intern		63 (15.75)	
Resident		134 (33.50)	
Specialist		171 (42.75)	
Subspecialist		29 (7.25)	
Type of specialty		Internist	161 (40.25)
		Cardiologist	45 (11.25)
		Infectious disease specialist	18 (4.50)
	Surgeon	32 (8.00)	
	Nephrologist	2 (0.50)	
	Endocrinologist	1 (0.25)	
	Gastroenterologist	6 (1.50)	
	Oncologists	17 (4.25)	
	Urologist	40 (10.00)	
	Neurologist	13 (3.25)	
	No specialty	65 (16.25)	
Diagnosed disease	Urinary tract infection (UTI)	55 (13.75)	
	Pneumonia	82 (20.50)	
	Deep vein thrombosis (DVT)	10 (2.50)	
	Asthma	8 (2.00)	
	Brucellosis	8 (2.00)	
	Weakness and fatigue	10 (2.50)	
	Gastroenteritis (GE)	16 (4.00)	
	Cellulitis	4 (1.00)	
	Sepsis	17 (4.25)	
	Diabetic foot ulcers	4 (1.00)	
	Abdominal pain	13 (3.25)	
	Cancer	20 (5.00)	
	Acute coronary syndrome (ACS)	6 (1.50)	
	Chronic obstructive pulmonary disease (COPD)	7 (1.75)	
	Colorectal diseases	6 (1.50)	
	Urinary tract diseases	27 (6.75)	
	Other	106 (26.50)	

Table 2. The most frequently prescribed antibiotics

Type of antibiotic	Frequency (%)
Ceftriaxone	138 (34.59)
Azithromycin	26 (6.52)
Cefazolin	51 (12.78)
Cefepime	1 (0.25)
Metronidazole	11 (2.76)
Ciprofloxacin	92 (23.06)
Clindamycin	9 (2.25)
Vancomycin	12 (3.01)
Meropenem	16 (4.01)
Imipenem	15 (3.76)
Cloxacillin	4 (1.00)
Levofloxacin	1 (0.25)
Rifampin	3 (0.75)
Gentamicin	11 (2.76)
Cotrimoxazole	1 (0.25)
Cefixime	3 (0.75)
Cefotaxime	2 (0.50)
Doxycycline	1 (0.25)
Ampicillin	1 (0.25)
Ampibactam	1 (0.25)

Based on various studies, the prevalence of inappropriate prescription of antibiotics is 50%, which even can reach 75% in surgical wards.^{16,17} Hence, currently the World Health Organization (WHO) and other health organization in the United States of America and some other countries have focused their policies on appropriate prescription and use of antibiotics, and made it a health priority.¹⁸ Nowadays, several studies are being

conducted in this field to determine the status of antibiotic prescription in every country, and design some plans to improve the trends.

In Rajalingam *et al.* study, the mean age of the studied patients was 49.25 ± 20.69 years, and the mean duration of hospital stay was 7.5 ± 4.18 days.¹³ Hence, our studied subjects had a shorter length of hospital stay (6.37 ± 2.69 days), and greater mean age (57.70 ± 9.87 years). The shorter length of stay which was observed in our study could be justified because the studied hospital was a general hospital; in addition, patients undergoing surgery usually have a shorter length of hospital stay. Considering that the mean age of people is increasing with the passage of time, it is normal to observe patients of older ages.

One of the methods used in antibiotic therapy is to add new antibiotics to the previous drug regimen. In Rajalingam *et al.* study, about 30% of the patients received two types of antibiotics simultaneously.¹³ In our study, with adding the second antibiotics to the drug regimen, the rate of errors and inappropriate prescriptions increased. This reflects the fact that by adding new antibiotics to the previous regime, the risk of error increases.

One of the reasons is that the majority of specialists in the fields of noninfectious diseases (especially in internal medicine which account for the majority of hospitalization and antibiotics prescriptions) have better knowledge in the initial selection or choice of drug;

Table 3. Frequency of appropriate type of antibiotic therapy by department

Objective for the antibiotic prescription	Department [Frequency (%)]			
	Internal	Infectious diseases	Surgery	Total
Treatment	146 (49.32)	27 (87.10)	9 (12.33)	182
Prophylaxis	3 (1.01)	0 (0)	37 (50.68)	40
unknown Indication	65 (21.96)	0 (0)	4 (5.48)	69
Inappropriate antibiotic administration	82 (27.70)	4 (12.90)	23 (51.31)	109
Total	296	31	73	400

however, when there is a need for more complicated treatments, or when facing drug resistance which makes it necessary to prescribe more complicated antibiotic regimens, the condition becomes more difficult to manage, and it will become necessary to ask for expert advice. Therefore, when facing a complex case of disease or facing drug resistance, it is essential to ask for advice from people who are expert in antibiotic therapy, and prevent random prescription of antibiotics.

In our study, overall in 28.57% of cases of antibiotic had been prescribed inappropriately. In a study by Hecker *et al.*, in 30% of cases the prescription was inappropriate,¹⁶ and in a study by Alavi Moghaddam *et al.*, 54% of cases of antibiotic prescription was inappropriate, and 40.2% of all cases with indication had received inappropriate dose or type of antibiotic.¹⁷

In a study by Ayuthya *et al.*, 26% of cases of antibiotic prescription were inappropriate.¹⁸ In other studies, the rate of inappropriate prescription was 61%,¹⁹ 32.3%,¹⁴ 46.7,²⁰ 23%,²¹ and 54%.¹⁷ Considering the results of this study and other studies, clearly there is a serious problem in this area and the majority of the health centers are faced with the problem. In some cases, even when there is an indication for the prescription of antibiotics, the dosage or type of prescribed antibiotic are inappropriate.

In our study, internal medicine ward had the largest share in the use of antibiotics (23.75%); however, the surgical ward has the largest share in inappropriate use of antibiotics (51.31%). In Raveh *et al.* study, 65.2% of the patients were admitted to internal medicine ward, and 64 ± 13 percent received antibiotics. The least amount of antibiotic prescription was observed in neonatal intensive care unit (NICU). Among all the wards evaluated in their study, emergency ward and NICU had the largest rate of appropriate antibiotic prescription (94%). However, the largest rate

of inappropriate antibiotic prescription was observed in surgical wards.² In Tunger *et al.* study, the rate of appropriate prescription of antibiotics was 46% in internal medicine ward, and 10% in gynecology ward.⁵ The largest rate of inappropriate prescription was observed in surgical ward (89.5%), and the lowest rate of inappropriate prescription was observed in the infectious diseases ward (56.8%) in Gangwar *et al.* study.¹¹ The results of most of the mentioned studies are in line with the results of our study. The majority of the patients are admitted to internal medicine ward; as the patients admitted to this ward are different and have various internal problems, the high rate of inappropriate prescription in this ward can be justified. Given the above-mentioned facts, the majority of training programs and plannings must be directed toward internal medicine ward (because of the large number of patients admitted to this ward), and surgical ward (because of the large prevalence of inappropriate prescription of antibiotics).

Considering the type of antibiotic, based on the results of our study, the most commonly used antibiotics were ceftriaxone (34.59%) and ciprofloxacin (23.06%), respectively. In studies by Rajalingam *et al.*,¹³ and Alavi Moghaddam *et al.*,¹⁷ cephalosporin was the most commonly used drug, while in Amane and Kop study,⁶ fluoroquinolones (norfloxacin) was ranked first among the prescribed antibiotics; the results of all the three mentioned studies are consistent with the results of our study. The above-mentioned reports indicate widespread and inappropriate use of fluoroquinolones and cephalosporins. Since urinary and respiratory tract infections are the most common reasons for starting antibiotics, the above-mentioned findings can be justified; because both of these drugs are among the list of first line therapy of respiratory and urinary tract infections.

Conclusion

Inappropriate antibiotic prescription is

currently a serious problem, and even it can be said that it is an emergency condition. The errors in antibiotic prescription are associated with its different dimensions, and in addition to inappropriate choice of antibiotic, the error may be related to inappropriate dosage, length of treatment, route of administration, combination therapy, and some other items. Surgical wards are more prone to inappropriate prescription of antibiotics. The current condition may be improved via making serious efforts to train and re-train the medical staffs, receiving proper and on-time expert advice, limiting the prescription of new antibiotics, and assigning some specialists to prescribe antibiotics.

Conflict of Interests

Authors have no conflict of interests.

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