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Investigation of Appropriacy of Antibiotics Used for a Day in a University Hospital

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Abstract

Antibiotics are important agents that have entered our lives with the discovery of penicillin and have an active role in treatment until today. Antibiotics, which are of great importance for modern medicine, ensure successful results in the treatment of many disease cases. In addition to successful results, there are also unsuccessful results. Apart from the intended use of antibiotics, when rational antibiotic use principles are ignored and they are not used properly, in that case, many problems can be encountered. One of the biggest problems for humanity is antimicrobial resistance to antibiotics. Antimicrobial resistance is a serious problem that can develop and threaten the world as a result of the wrong and unconscious use of antibiotics. It is aimed to apply rational antibiotic use principles in order to emerge from this risky situation. It is possible to explain the rational use of antibiotics in the correct diagnosis, using the correct antibiotic in the right dose and at the right time. Today, many health organizations are engaged in activities aimed at realizing rational antibiotic use in hospitals and society. Taking advantage of the current antibiotic treatment guides and raising awareness of the public about the use of antibiotics by healthcare professionals are among the objectives of these activities.

In our study, daily antibiotic use in a university hospital was investigated, and demographic data, clinical units, antibiotics used, intended uses, antibiogram test, and suitability of antibiotics used were investigated. As a result of the necessary examinations, it was determined that 47.8% of the patients who came to the hospital on a working day received antibiotic treatment and 61.8% of these antibiotics applied were appropriate and 38.2% were not.

Keywords: Antibiotics, rational antibiotic use, antimicrobial resistance, inappropriate use, surgical prophylaxis guide.

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Introduction

Antibiotics are important therapeutic agents with a history of approximately 70-80 years and are used in the treatment of infectious diseases. They are used in the treatment of bacterial infections in both humans and animals and have played an active role in the treatment for decades (1). Infectious diseases are an area where success is achieved with appropriate antimicrobial treatment and is very important in terms of public health. Infectious diseases acquired in the community or in hospitals could not be treated or lead to patient deaths if the rational use of antibiotics is not carried out. With the right antimicrobial treatment; It is possible to reduce the severity and duration of the disease by preventing survival, complications, and chronicity of the disease (2). In order for the antimicrobial treatment to proceed in accordance with its purpose, after the correct diagnosis is made, the 'correct antibiotic' with the most appropriate administration route and effective dose should be selected and it should be applied at optimum intervals and for the appropriate duration (3). Examples of unnecessary and inappropriate use of antibiotics are; antibiotic chemotherapy with underdiagnosis, administration of more than one antibiotic at the same time if it is not necessary, inaccurate dose and dose intervals, and using an expensive antibiotic instead of cheap antibiotics with known efficacy (4).

Inappropriate use of antibiotics leads to increased resistance development, cost, and, drug side effects. Furthermore, the problem of antibiotic resistance is increasing day by day and the antibiotic options that can be applied for the treatment of infections caused by resistant microorganisms are decreasing (5).

One of the issues that have been at the top of the global health agenda in recent years, due to its impact on public health and economic costs, is antimicrobial resistance (6). AAntimicrobialstance, which occurs with the irrational use of antibiotics, reduces the expected effect from antibiotics, causing the treatment to become difficult, costly, or even impossible (7). In particular, the increasing rates of antimicrobial resistance in the world in recent years have had adverse effects on global health, the global economy, sustainable development, trade, and the stability of countries. When the use of antibiotics is evaluated in terms of global public

health, it is seen that approximately 700.000 people die every year due to antibiotic resistance (8). Turkey ranks as the 2nd country with the highest antimicrobial resistance rates among the countries with data in the world. Furthermore, it is also the country with the highest antibiotic consumption level in the world. What these rates, antimicrobial resistance poses a critical threat to public health in Turkey. Therefore, policies and programs developed with the aim of reducing antibiotic use are at the top of Turkey's health agenda (9).

In this study, we will take a cross-sectional view of antibiotic treatment administered over a day in a university hospital.

Materials and Methods

This study was performed retrospectively and cross-sectionally by collecting and using the demographic information, clinical information and antibiotic treatment data of outpatients and inpatients admitted to a university hospital in Istanbul on the same day.

The study includes data on the antibiotic treatment practices of 15 clinics (intensive care unit, pediatry, Ear Nose Throat, internal medicine, neonatology, orthopedics, plastic and cosmetic surgery, general surgery, cardiovascular surgery, pulmonary diseases, Infectious Diseases, and Clinical Microbiology, gynecology, cardiology, and neurology) where the patients applied or were hospitalized that day.

For the study, patient epicrisis files prepared by doctors and nurses and registered documents in the electronic hospital documentation system were used. The data of the patients (age, gender, clinic units they applied to and hospitalized, their diagnoses, the status of antibiogram culture tests, the antibiotics used in the treatment, and the suitability of these antibiotics for treatment) were transferred to a Microsoft Excel program and analyzed. After the examination and evaluation, the data were categorized and expressed in percentages. Organized evaluations are tabulated and included in the results section.

Results

On the selected day for the study (14.01.2020), a total of 230 patients, including outpatients and inpatients, applied to the university hospital. Antibiotic use was prescribed for 110 patients out of 230 patients who consulted the hospital. The rate of using antibiotics in the hospital was recorded as 47.8%. The basic characteristics of the participants are presented in Table 1.

Table 1. Demographic Characteristics of the Patients

Variables	**Patients (n)**	**%**	**Mean**
Age	-	-	39,7
Gender			
Female	54	49,1%	
Male	56	50,9%	
Total	**110**	**100%**	

49.1% (n=54) of the patients included in the study were female and 50.9% (n=56) were male. The mean age of all these cases using antibiotics is 39.7 years. No age range was limited in the study, the age range of the cases was determined as 0-98 years.

Considering the distribution of the clinics in the study according to the number of patients, the intensive care unit has the most patients with 25.4% (n=28). Pediatrics (15.4%, n=17), Ear Nose Throat (11,8%, n=13), internal medicine (10.9%, n=12), neonatology (9.1%, n=10), orthopedics (6.4%, n=7), neurosurgery and plastic and cosmetic surgery (4.5%, n=5), general surgery and cardiovascular surgery (2.7%, n=3), pulmonary diseases and Infectious Diseases (1.8%, n=2) and gynecology and neurology (0.9%, n=1).

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Table 2. Distribution of the Cases in the Study by Clinics

Clinic	Patiens (n)	%
Intensive Care Unit	28	25,4%
Pediatrics	17	15,4%
Ear Nose Throat	13	11,8%
Internal medicine	12	10,9%
Neonatology	10	9,1%
Orthopedics	7	6,4%
Neurosurgery	5	4,5%
Plastic and cosmetic surgery	5	4,5%
General surgery	3	2,7%
Cardiovascular surgery	3	2,7%
Pulmonary diseases	2	1,8%
Infectious Diseases	2	1,8%
Cardiology	1	0,9%
Gynecology	1	0,9%
neurology	1	0,9%
Total	**110**	**100%**

A variety of antibiotics were used in clinics. Thirteen different antibiotics were found in patient records. When the number and percentage distributions of antibiotics used were examined, the most commonly used antibiotic was ceftriaxone with 41.8% (n=46). Meropenem (16.3%, n=18), ampicillin-sulbactam (10.9%, n=12), cefazolin sodium (9.1%, n=10), piperacillin-tazobactam and clarithromycin (5.4%, n=6), ampicillin and moxifloxacin (2.7%, n=3),

amikacin sulfate (1.8%, n=2), fluconazole, gentamicin, cefuroxime sodium and cefotaxime sodium (0.9%, n=1).

Table 3. Number and Percentage Distribution of Antibiotics Used

Antibiotics	**Patients (n)**	**%**
Ceftriaxone	46	41,8%
Meropenem	18	16,3%
Ampicillin-sulbactam	12	10,9%
Cefazolin sodium	10	9,1%
Piperacillin-tazobactam	6	5,4%
Clarithromycin	6	5,4%
Ampicillin	3	2,7%
Moxifloxacin	3	1,8%
Amikacin sulfate	2	1,8%
Fluconazole	1	0,9%
Gentamicin	1	0,9%
Cefuroxime sodium	1	0,9%
Cefotaxime sodium	1	0,9%
Total	**110**	**100%**

Treatments were started an after antibiogram test was performed to detect antibiotic sensitivity in 37.3% (n=41) of the patients included in the study. Antibiogram test was not performed in 68.3% of the patients (n=69).

IJBCS
ISSN: 2147-1428

Table 4. Distribution of Antibiogram Tests Performed on Patients in Number and Percentage

Antibiogram Tests Performed	Patients **(n)**	**%**
Yes	41	37,3%
No	69	68,3%
Total	**110**	**100%**

61.8% of the antibiotics, used by the patients, were suitable for use, and 38.2% were not.

Table 3. Number and Percentage Distribution of Antibiotics Used in the Study According to Their Purpose of Use and Suitability

Intended use	Patients (n, %)	**Appropriate**	**Inappropriate**
Empirical	47 (42,7%)	15 (31.9%)	32 (68,1%)
Prophylactic	23 (20,9%)	13 (56.5%)	10 (43,5%)
Microorganism specific	40 (36,4%)	40 (100%)	0
Toplam	**110 (100%)**	**68 (61.8%)**	**42 (38.2%)**

Considering the purpose of the use of antibiotics in the study; It was observed that 42.7% (n=47) of the patients received empirical treatment, 20.9% (n=23) prophylaxis treatment, and 36.4% (n=40) microorganism-specific treatment. When the suitability of these treatments is examined; 31.9% (n=15) of antibiotics used for empirical treatment were appropriate, 68.1% (n=32) were not; 56.5% (n=13) of antibiotics used for prophylaxis treatment were appropriate, 43.5% (n=10) were not. All microorganism-specific treatments were 100% (n=40) appropriate.

Table 4. Distribution of Conformity of Antibiotics Used in the Study as Number and Percentage

Conformity of Antibiotics	**Patients (n)**	**%**
A**ppropriate**	68	61,8%
I**nappropriate**	42	38,2%
Total	**110**	**100%**

Discussion

Antibiotics, which are widely used all over the world, are among the drug groups that are widely used in our country. It is seen that antibiotics are used far from rational use in many cases. The irrational use of antibiotics causes many problems as antimicrobial resistance, treatment failures, the incidence of side effects, and the economic burden of treatment (10).

In this study, one-day antibiotic use and suitability in a university hospital in Istanbul were examined cross-sectionally. In a study by Vesparten et al. (2018), a total of 303 hospitals from 53 countries participated. 52.1% of the patients were male and 47.9% were female. (11). In a study by Ertuğrul et al. (2009) in the surgical wards of a university hospital, 52.9% (n=37) of the patients were male, 47.1% (n=33) were female, and 54.3% of the patients were using antibiotics. (12). The mean age of the patients was 52.9. In a study by Tartar et al. (2015), 52.7% (n=127) of the patients using antibiotics in a university hospital in Elazig were male, 47.3% were female, and the mean age of the patients was 52.19. (13). 44.4% of the participants in the multicenter study including pediatric patient groups by Ceyhan et al. (2010) were female and 55.6% were male. The mean age of these patients was 49.51 months (14). 51.8% (n=57) of the patients included in our study were male and 48.2% (n=53) were female. The mean age is 39.7. Demographic characteristics in our study are consistent with other studies in the literature.

It was observed that antibiotic treatment was empirical in 92.8% of the patients in the study of Öztürk et al. (2019), and 7.2% was started according to the culture antibiogram test. (10). It was determined that 61.9% of the antibiotics used in the study were appropriate. Devrim et al. (2009) found that 82.8% (n=111) of the antibiotics used in the study were empirical treatment, 12.7%

(n=17) was prophylaxis treatment, and 4.5% (n=6) was the treatment used according to the results of the culture test. 34% of antibiotics used in the empirical treatment and 58.8% of antibiotics used in prophylaxis treatment were inappropriate. The antibiotics preferred for microorganism-specific treatment are 100% appropriate. (15). In the study of tartar et al. (2015), antibiotic treatments were started empirically in 49% of the patients, for prophylaxis in 36.5%, and based on culture results in 14.5% of the patients. It has been determined that 83.1% of the antibiotics used in empirical treatment, 100% of the microorganism-specific antibiotics, and 10% of the antibiotics used for the prophylaxis treatment were appropriate (13). In the study conducted by Yılmaz et al. (2014), 61.3% of antibiotic treatments were started empirically, 16.5% prophylactically, and 22.9% according to culture results. 18% of antibiotics used in empirical treatment, 6.5% of those used according to culture results, and 69% of those used prophylactically were inappropriate. In our study, 61.8% (n=68) of the antibiotics used were found appropriate, while 38.2% (n=42) were found inappropriate. (16). Although the rates in our study have similarities with these studies, there are also differences.

It was observed that 42.7% (n=47) of the antibiotics in our study were used for empirical treatment, 20.9% (n=23) for prophylaxis treatment, and 36.4% (n=40) according to culture antibiogram results. Considering the antibiotic compatibility of the treatments themselves; 31.9% (n=15) of patients who received empirical therapy received appropriate antibiotic therapy. Considering the reasons for the higher rate of inappropriate antibiotic use, it was seen that broad-spectrum antibiotics such as ceftriaxone, which is one of the third-generation cephalosporins, were used more frequently than narrow-spectrum antibiotics, and this was inappropriate because it could cause many problems, especially antimicrobial-resistance. When the patients receiving prophylactic antibiotic treatment were evaluated; 56.5% (n=13) received appropriate antibiotic therapy. We found that the most commonly used antibiotics in the prophylaxis treatment in our study; were ceftriaxone, cefazolin, and ampicillin-sulbactam. When compared with the literature, it was seen that the antibiotics used for prophylactic purposes, which we found in our study, were chosen appropriately at a higher rate. Appropriate antibiotics vary according to surgical unit and operation in surgical prophylaxis guidelines. The

rate of compliance with the surgical prophylaxis guideline of the hospital where the study was conducted was found to be 56.5%. Inappropriate prophylactic antibiotic treatment arises due to the application of unnecessary prophylaxis treatment and the choice of inappropriate antibiotics. When the antibiotic treatment started according to the results of the culture antibiogram test, it was observed that 100% (n=40) of appropriate antibiotic treatment was started. Having an infectious disease specialist consultation and the detection of the microorganism makes it possible to choose the right antibiotic and perform appropriate treatment.

Conclusion

With this cross-sectional research we have carried out; The use of antibiotics in the relevant university hospital was evaluated by many criteria and their suitability for treatment purposes was determined. The results obtained have some inadequacies that can be completed with a more extended study. Inappropriate treatment rates can be reduced by increasing compliance with rational antibiotic use principles. The principles of rational antibiotic use are closely related to all health personnel and patients who are involved in the patient and treatment, including doctors, pharmacists, and nurses. In order for this issue to reach the desired point, awareness seminars should be organized within the hospital and all healthcare professionals should be made aware of the rational use of antibiotics. Moreover, activities such as brochures, TV broadcasts and patient information meetings should be organized to increase the awareness level of patients. Surveillance of patients receiving antibiotic therapy should be meticulously ensured.

Since antibiotics are agents that are the focal point not only in Turkey but all over the world, seminars and congresses on rational antibiotic use are held every year at the international level. Pharmacists and doctors working in the hospital should participate in these organizations and revise their knowledge. Such cross-sectional studies should be repeated at regular intervals in order to determine the current antibiotic use status and suitability in hospitals, and necessary corrections should be made for missing issues.

Conflict of interest: The authors have no conflict of interest in this paper

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