

ORIGINAL ARTICLE / ÖZGÜN MAKALE

Evaluation of Antibiotic Consumption in Hospital: Single-Center Point Prevalence Study

Hastanede Antibiyotik Tüketiminin İncelenmesi: Tek Merkezli Nokta Prevalans Çalışması

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Geliş: 25.09.2024, Kabul: 24.12.2024

Abstract

Objective: The purpose of the research is to evaluate antibiotic consumption in hospitalized patients with a single-day point prevalence study.

Material and Methods: The study was conducted at Yalova Training and Research Hospital (YTRH) on April 12, 2023. The research day, patients in all clinics and intensive care units were visited, and information about the sociodemographic data of the patients and the antibiotics used was recorded in the antibiotic consumption form. The resulting box-based consumption was analyzed in the SPSS program in the Defined Daily Dose (DDD) unit of the World Health Organization.

Results: 150 patients included in the research, and 100 patients received antibiotics. Antibiotic use rate was found to be 66.66%. 55 of the patients receiving antibiotics were female and the mean age was 66.36±18.54 (min:19, max:92) years. The total amount of antibiotics consumed was 839.60 DDD/1000 patient-days (DPD). When antibiotic consumption was evaluated according to units, it was seen that the patients using antibiotics the most were in surgical wards (n: 47; 227.4 DPD), and the highest antibiotic consumption was in intensive care units (ICU) (n: 29; 399.83 DPD). The first three antibiotics most used in the hospital were moxifloxacin, ceftricasone and ciprofloxacin, respectively.

Conclusions: The study found that 66% of patients used at least one antibiotic, the most commonly used units were the ICU, and the most commonly used antibiotic groups were quinolones, cephalosporins and carbapenems. Antibiotic consumption should be monitored using the point prevalence method, feedback should be provided and awareness should be raised by implementing antibiotic stewardship programs in the hospital.

Keywords: Antibiotic, Antibiotic consumption, Point prevalence

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How to Cite: Kaya G, Ergenç Z, İncirkuş Küçük, Ergenç H, Aksaray S. Evaluation of antibiotic consumption in hospital: Single-center point prevalence study. *Journal of Immunology and Clinical Microbiology* 2024;9(4):101-108

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Öz

Amaç: Bu çalışmanın amacı, hastanede yatan hastalarda antibiyotik tüketimini tek günlük nokta prevalans çalışmasıyla değerlendirmektir.

Gereç ve Yöntem: Çalışma, 12 Nisan 2023 tarihinde Yalova Eğitim ve Araştırma Hastanesi'nde (YEAH) gerçekleştirildi. Araştırma günü, tüm servis ve YBÜ'deki hastalar ziyaret edilerek hastaların sosyodemografik verileri ve kullanılan antibiyotiklere ilişkin bilgiler antibiyotik tüketim formuna kaydedildi. Elde edilen nokta prevalans, Dünya Sağlık Örgütü'nün Günlük Tanımlanmış Doz (GTD) biriminde SPSS programında analiz edildi.

Bulgular: Araştırmaya 150 hasta dahil edildi ve 100 hastanın antibiyotik aldığı tespit edildi. Antibiyotik kullanım oranı %66,66 olarak belirlendi. Antibiyotik kullanan hastaların %55'i kadın olup yaş ortalaması 66,36±18,54 (min:19, max:92) yıl idi. Tüketilen toplam antibiyotik miktarı 839,60 GDD/1000 hasta-günü (GHG) idi. Birimlere göre antibiyotik tüketimi değerlendirildiğinde en fazla antibiyotik kullanan hastaların cerrahi servislerde (n:47; 227,4 GHG) olduğu, en fazla antibiyotik tüketiminin ise yoğun bakım üniteleri (YBÜ)'nde (n:29; 399,83 GHG) olduğu görüldü. Hastanede en çok kullanılan ilk üç antibiyotik sırasıyla moksifloksasin, seftriakson ve siprofloksasin oldu.

Sonuç: Araştırmada hastaların %66'sının en az bir antibiyotik kullandığı, en çok kullanılan birimlerin YBÜ olduğu, en çok kullanılan antibiyotik gruplarının ise kinolonlar, sefalosporinler ve karbapenemler olduğu belirlendi. Nokta prevalans yöntemiyle antibiyotik tüketimi izlenmeli, geri bildirim sağlanmalı ve hastanede antibiyotik yönetim programları uygulanarak farkındalık artırılmalıdır.

Anahtar Kelimeler: Antibiyotik, antibiyotik tüketimi, nokta prevalans

INTRODUCTION

Antibiotics, which have contributed to the treatment of diseases and paved the way for modern medicine for more than 100 years with the discovery of antibiotics by Sir Alexander Fleming in the 1900s, are used in many medical disciplines such as the treatment of infectious diseases, organ transplantation, rheumatology, oncology, invasive procedures and pre-surgery (1-3). However, over time, inappropriate and long-term use of antibiotics has become an important public health problem that poses a global threat of antibiotic resistance. Many microorganisms can become resistant to antimicrobial drugs currently in use by developing more than one resistance mechanism. With the development of antimicrobial resistance, problems such as the increase in resistant bacterial infections, increased occurrence of antibiotic side effects, triggering an increase in morbidity

and mortality, and consequently an increase in the economic burden on health (4,5).

Frequent and excessive use of antibiotics is a global health problem in low- and middle-income countries where access to quality healthcare is limited and regulations on antibiotic use are inadequate (6). According to the report of the World Health Organization (WHO) on "Antibiotic use in Eastern European countries", Turkey is among the countries with high total antibiotic use. Legal regulations are made in our country regarding the rational use of antibiotics, which is called giving antibiotics to the right patient, for the right indication, for the right time and in the right dose range, and with the law enacted in 2014, antibiotics are administered only with a physician's prescription. However, despite these regulations, there are scientific reports indicating that a large proportion of antibiotics used in treatment are inappropriate use. Inappropriate antibiotic

use, especially in inpatients, causes the emergence of resistant microorganisms throughout the hospital, increases mortality and morbidity, and increases the length of hospital stay (7,8).

Conducting point prevalence studies on antibiotic use in hospitals is a guiding surveillance method in determining antibiotic use situations. The aim of this study is to evaluate antibiotic consumption in hospitalized patients with a single-day point prevalence study.

MATERIAL AND METHODS

Study design

This study, planned as a single-day point prevalence study, was conducted at Yalova Training and Research Hospital (YTRH). YTRH is a tertiary care hospital with a total of 400 beds, 100 of which are intensive care unit (ICU) beds. Ambulatory patients were excluded. All inpatients visited between 08:00 and 17:00 pm on the day of the study in each department concerned. An antibiotic consumption form (ACF) was prepared before the study, and the inpatient services and intensive care units in the hospital were visited by the study team on the study day (April 12, 2023). ACF consisted of demographic data and information on antibiotic use. Antibiotic consumption (in milligrams) in ICU, internal wards and surgical wards was recorded in ACF.

Calculation of antibiotic consumption

Antibiotic use was calculated by the 'Anatomical Therapeutic Chemical/Defined Daily Dose (ATC/DDD)' method suggest that the WHO and explained as DDD/1000 patient-days (DPD).

Statistics

Point surveillance data were recorded on the point surveillance form created by the researchers. Data analysis was done SPSS 22 for Windows (Statistical Package for Social Science, SPSS® Corp., Armonk, NY, USA). Categorical variables will be displayed with frequency and percentage and analyzed with the chi-square test. Continuous variables were first tested for normality using the Shapiro-Wilk test. Continuous variables

complying with normal distribution were shown with arithmetic mean±standard deviation and minimum and maximum values and were evaluated with the t-test. Continuous variables that did not comply with normal distribution were shown as median, first and third interquartile range values and analyzed with the Mann-Whitney test. Evaluation of two consecutive measurements was done using the Wilcoxon test (paired samples). The significance level was taken as <0.05 (confidence interval 95%).

Ethical considerations

Ethics approval for the study was taken from Yalova University Human Research Ethics Committee with protocol number 2023/109. All participants were informed before the study and were included in the study after their consent was obtained. The study was conducted in accordance with the principles of the Declaration of Helsinki.

RESULTS

150 patients hospitalized in various departments were included in the study and it was seen that 100 patients received antibiotics. Analyzes were performed on a total of 100 patients (29 in intensive care units, 24 in internal services and 47 in surgery services) data. The median age was 66 years, with the largest group aged between 18 and 92. The sex ratio was 0.81, with 55 (55%) female subjects and 45 (45%) male subjects. 74% of the patients had at least one chronic disease. The median hospitalization day of the patients was 3.50 [2.00-08.00] days. 38% of patients had undergone surgery, and the median postoperative hospital stay was 2.0 [1.00-6.00] days.

The antibiotic use rate was found to be 66.6%, and 55% of the patients receiving antibiotics were receiving single antibiotics (144.25 DPD), 33% were receiving double antibiotics (380.70), 8% were receiving triple antibiotics (190.55 DPD) and 4% were receiving quadruple antibiotics (124.09 DPD) ($p=0.000$). The frequency of antibiotic receive according to hospital departments is shown in Table 1. Total antibiotic consumption in the study day was 839.6 DPD.

When antibiotic consumption is evaluated according to units; It was observed that the patients who used the most antibiotics were in surgical clinics (n: 47, 83.9%, 227,4 DPD) and the highest amount of antibiotic use was in intensive care units (n: 29, 69.0%, 399.83 DPD) (Table 2). The first three antibiotics most used in the hospital were moxifloxacin, ceftriaxone and ciprofloxacin respectively (Figure 1). The most frequently used antifungal was fluconazole (Figure 1).

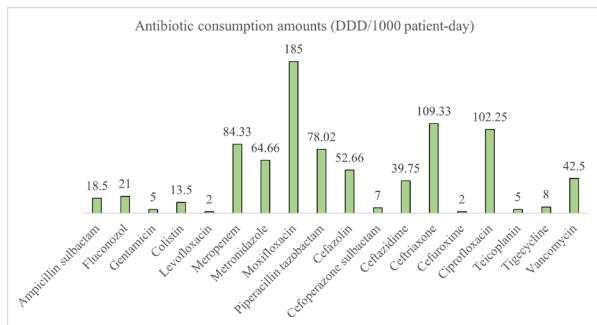


Figure 1. Antibiotic and antifungal consumption amounts (DDD/1000 patient day)

Table 1. Data on patients' demographic information and antibiotic consumption information

	n/mean (min-max)/median [Inter-quartile range]
Inpatient	150
Patient taking antibiotics	100
Antibiotic use rate %	66.6
Age	66.3 (18.0-92.0)
Gender	
Female	55
Male	45
Chronic disease	
Yes	74
No	26
Hospital admission day	3.50 [2.0-8.0]
Patient having surgery	38
Postoperative hospital day	2.0 [1.0-6.0]
Distribution of patients receiving antibiotics	
Patient receiving single antibiotics	55
Patient receiving double antibiotics	33
Patient receiving triple antibiotics	8
Patient receiving quadruple antibiotics	4

Table 2. Antibiotic use prevalence in intensive care units and services

	Intensive care units n: 42	Internal services n: 52	Surgery services n: 56	P value
Number of patients using antibiotics	29 (69.0)	24 (46.1)	47 (83.9)	0.000*
Antibiotic consumption amount (DPD)	399.8	212.3	227.4	0.000**

* chi-square test, p<0.05; **Kruskal Wallis test, p<0.05

DISCUSSION

Point prevalence studies in hospitals are widely used to determine antibiotic exposure (9-11). In our point prevalence study, we found that the antibiotic use rate was 66.6%. In a multicenter point surveillance study investigating the use of antibiotics in hospitalized patients in Northern Nigeria, it was found that 80.1% of the patients used at least one antibiotic on the day of the research (12). In a multicenter point surveillance study on antibiotic use in Pakistan, it was found that 77.6% of

hospitalized patients received antibiotic treatment (13). In a point surveillance study conducted in Benin, the point prevalence of antibiotic treatment was 64.6%, and 30% of uninfected patients were reported to have received antibiotics (14). In a study conducted in public hospitals in Ethiopia, the overall prevalence of antibiotic consumption was found to be 63.8% (15). In a point prevalence study on antimicrobial consumption in Brazilian hospitals, it was found that 52.2% of patients used antibiotics (16). In another point surveillance study conducted in intensive care units in Brazil, the prevalence of antibiotic use was reported

to be 52.4% (17). In a study reported on the use of antibiotics in hospitals of the Ministry of Health in Saudi Arabia, the rate of antibiotic consumption was reported as 46.9% (18). In a point prevalence study conducted in Canadian hospitals, it was shown that 34.0% of inpatients were given antimicrobials (19). In a single-center study conducted to evaluate antibiotic use in Turkey, it was reported that 47.7% of patients received at least one antibiotic (20). In a multicenter point prevalence study conducted to determine antibiotic consumption in Turkish hospitals, it was determined that 44.8% of patients received at least one antibiotic (21). In another point prevalence study conducted in our country, it was determined that 30.3% of patients used antibiotics (22). Antibiotic consumption in hospitals varies from one continent to another, from one country to another, and from one department to another. According to these data, it has been observed that antibiotic use rates in hospitals vary between 30% and 80%. Authors in some countries have attributed this high consumption of antibiotics to the relatively high number of tuberculosis cases and the number of patients living with HIV (immunosuppression) (23). In our study, more than half of the inpatient in our hospital use antibiotics. This situation should be handled carefully, precautions should be taken for rational antibiotic use and antibiotic management programs should be developed.

Since the daily defined doses of antibiotics differ from each other, WHO has recommended the use of the ATC/DDD calculation method to ensure standardization of consumed antibiotics (24). Using the WHO ATC/DDD method, we determined that the amount of antibiotics consumed in our study was 839.6 DPD. In a study that systematically reviewed antibiotic consumption in acute care hospitals, it was found that the aggregate rate of antibiotic consumption throughout the hospital was 586 DDD for all antibacterials (25). In a study conducted in Vietnam, the average antibiotic consumption of the hospital was found to be 918 DDD/1000 patient-days (26). The average antibiotic consumption in a tertiary hospital

in Korea was found to be 920.69 DDD/1000 patient-days (27). The Australian national antimicrobial annual report states that the antibiotic consumption was 883 DPD in the country in 2019 (28). In the multicenter point surveillance study carried out in our country, the mean antibiotic consumption amount was calculated as 674.5 DPD (21). In a study conducted to define antibiotic consumption with the participation of 530 hospitals in France, it was reported that 633 DPD antibiotics were used in teaching hospitals (29). It was determined that the total antibiotic consumption of patients hospitalized in a teaching hospital in Nigeria was 260.9 DDD/100 bed-days (30). In a study investigating antibiotic consumption in a 610-bed, tertiary hospital in Quito, Ecuador, researchers found that the average antibiotic prescription rate in the hospital was 148.8 DDD/100 patient days (31). In the study of Borg et al., in which antibiotic consumption was investigated in Southern and Eastern Mediterranean hospitals, including our country, the median value of antibiotic consumption was reported to be 112 DDD/100 bed-days (32). As seen in the literature, antibiotic use in our hospitals is higher than in some countries and lower than in others. We predict that antibiotic consumption may be related to the antibiotic management programs implemented in countries rather than the development level of the country. We believe that as antibiotic consumption decreases with the implementation of antibiotic stewardship programs, both antimicrobial resistance and related expenses will decrease.

Intensive care units represent the most used antibiotic burden in the hospital and are also considered as a department that creates, spreads and strengthens antibiotic resistance, which is important from a microbiological point of view (33). Serious or life-threatening infections are common in patients in the ICU. Following complicated cases in the ICU, the severity of the infections seen, the complexity of the decision-making process and the employment of physicians with limited antibiotic knowledge make it difficult to implement antibiotic management programs in these

departments. In our study, it was founded that the department that consumed the most antibiotics was intensive care units. The amount of antibiotics consumed in the ICU was 399.8 DPD; This rate is approximately twice as high as in surgical and internal departments. In the study in which antibiotic consumption in acute care hospitals was systematically reviewed, it was determined that the unit where the most antibiotics were consumed was the ICU (1563 DDD) and was approximately twice as high as the mean amount of antibiotics consumed (586 DDD) (25). In a study carried out in a tertiary hospital in Kenya, the frequency of rational antibiotic use was 18.5%; Inappropriate antibiotic selection (51.0%) and wrong duration (32.3%) were determine to be the most widespread irrational practices (34). It is thought that continuous in-service training of physicians working in ICUs in order to increase their antibiotic knowledge and regular surveillance of ICUs can contribute to the rational use of antibiotics in ICUs, both by regulating the antibiotic treatments of patients and by being a role model for physicians working in these departments.

In our study, the most widely consumed antibiotics in the hospital were moxifloxacin, ceftrixasone, ciprofloxacin and meropenem. In a multicenter point prevalence study investigating antibiotic consumption among hospitalized patients in Northern Nigeria, it was showed that the most frequently prescribed antibiotics were metronidazole, ciprofloxacin, ceftriaxone, amoxicillin-clavulanate and gentamicin (12). In a point prevalence study investigating the use of antibiotics in Ethiopian public hospitals, the most frequently consumed antibiotic in the hospital was ceftriaxone, followed by metronidazole (13). In a point surveillance survey conducted on antibiotic use in twenty six Saudi hospitals, it was observed that the most frequently prescribed antibiotic group was third-generation cephalosporins (14). In the multicenter point surveillance study conducted by Saleem et al. in Pakistan, the three most frequently prescribed antibiotics were ceftriaxone, metronidazole and ciprofloxacin (13). While the most commonly prescribed antibiotics

in Botswana public hospitals are cefotaxime and metronidazole, it has been determined that it is ceftriaxone in private hospitals (35). In the study conducted in Turkish hospitals, it was concluded that the most frequently consumed restricted antibiotics were carbapenems, piperacillin-tazobactam and intravenous quinolones, in the order of use, and one of the most commonly consumption unrestricted antibiotics was cephalosporins (21). In another study from Turkey, the most frequently used antibiotic on the spot surveillance day was fluoroquinolones used by 1,147 patients; This was followed by carbapenems and first-generation cephalosporins, used by 1,127 and 1,088 patients, respectively (22). The results of our study are compatible with the literature.

Study Limitations: The most important limitations of our study can be listed as the fact that it was conducted in a single center and only the amounts of antibiotics consumed were examined without evaluating the suitability of antibiotics for their intended use. However, in our study, no distinction was made between preoperative prophylactic antibiotic use and therapeutic antibiotic use. By paying attention to these points in future studies and planning large-scale multi-center studies, the level of irrational antibiotic use in hospitals can be revealed.

CONCLUSION

As a result, it was observed that more than half of the inpatients in our study used antibiotics, the most frequently used antibiotics were moxifloxacin, ceftrixasone, ciprofloxacin and meropenem, and the highest use was in ICUs. The high amount of antibiotic consumption in our hospital is related to the resistant microorganisms seen in our country. Antibiotic management programs that will ensure the rational use of antibiotics should be used in hospitals, antibiotic consumption amounts should be monitored and feedback should be given to the units regarding antibiotic consumption.

ACKNOWLEDGMENTS

Conflict of interest statement: The authors report no conflict of interest.

Funding: This study received no extramural funding

Author Contribution: Surgical and Medical Practices: G.K., Z.E., H.İ.K., H.E., S.A., Concept: G.K., Z.E., H.İ.K., H.E., S.A., Design: G.K., Z.E., H.İ.K., H.E., S.A., Data Collection or Processing: G.K., Z.E., H.İ.K., H.E., S.A., Analysis or Interpretation: G.K., Z.E., H.İ.K., H.E., S.A., Literature Search: G.K., Z.E., H.İ.K., H.E., S.A., Writing: G.K., Z.E., H.İ.K., H.E., S.A.

*This study was presented as a poster presentation at the 38th ANKEM Congress held in Acapulco Congress Center / TRNC on 1-4 June 2023 (PB-17).

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