

ANTIBIOTIC USAGE AND APPROPRIATENESS AT A UNIVERSITY HOSPITAL IN TURKEY: POINT PREVALENCE RESULTS

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ABSTRACT

Objective: This study aims to determine antibiotic usage rates, causes of antibiotic usage and inappropriate usage rates in a university hospital with a 1200-bed capacity.

Material and Method: The study assessed antimicrobial drug usage among all hospitalised patients at the hospital on April 20, 2012, using the point prevalence method. Data were recorded using pre-prepared forms. Appropriateness of antibiotic usage was determined according to the appropriateness for the cause of antibiotic usage, the spectrum of the chosen antibiotics, usage dose, dose frequency and period of usage.

Results: Of 666 patients staying in the hospital on the day of study, 262 (39.7%) were on antibiotics. Of those, 145 (55.3%) were on surgical wards, 98 (37.4%) were on medical wards and 19 (7.3%) were on paediatric wards. Of those 262 patients, 157 (59.9%) were taking only one type of antibiotic, 79 (30.2%) were taking two and 26 (9.9%) were taking three or more types of antibiotic. Antibiotic usage was appropriate in 55.7% (146 patients) and inappropriate in 44.3% (116 patients). The inappropriate antibiotic usage rate was 75.9% (88 patients) among patients on surgical wards. The most common cause of inappropriate usage was unnecessarily long prophylaxis time (68.2%, 60 patients). Inappropriate antibiotic usage was found in 24 (24.5%) patients out of 98

patients on medical wards. When the causes of antibiotic usage were analysed, it was found that the cause of antibiotic usage was infection in 36.2% (95 patients), prophylactic in 35.9% (94 patients), and empirical in 27.9% (73 patients). On the day the study was conducted, 367 antimicrobial drug were prescribed to 262 patients. The drugs most commonly prescribed were antibiotics from the cephalosporin (n=99, 27.0%) and fluoroquinolone (n=74, 20.2%) groups. When the diagnosis of 95 patients who were on antibiotics due to infection was reviewed, the most common infections were respiratory tract infections (n=36, 37.9%), urinary system infections (n=12, 12.6%), upper respiratory tract infections (n=8, 8.4%), bloodstream infections (n=6, 6.3%) and prosthesis infections (n=6, 6.3%).

Conclusion: Inappropriate antibiotic usage rates in surgical wards were high. This inappropriate usage was especially related to prophylaxis time. This is why it is necessary for surgeons to be educated regarding prophylactic antibiotic usage and to stick to the surgical prophylaxis guidelines. In addition, regular point prevalence studies regarding antibiotic usage performed using a web-based national database would be very helpful in determining inappropriate antibiotic usage and finding solutions to this problem.

Key Words: Prevalence, antibiotic, hospital Nobel Med 2013; 9(3): 98-103

TÜRKİYE'DE BİR ÜNİVERSİTE HASTANESİNDE ANTİBİYOTİK KULLANIMI VE UYGUNLUĞU: NOKTA PREVALANS SONUÇLARI

ÖZET

Amaç: Bu çalışma; 1200 yatak kapasiteli bir üniversite hastanesinde yatan hastaların antibiyotik kullanma oranları, kullanma nedenleri, uygun olmayan kullanım oranının belirlenmesi amacıyla yapılmıştır.

Materyal ve Metod: Çalışmada 20 Nisan 2012 tarihinde hastanemizde yatan tüm hastaların antimikrobik ilaç kullanımı nokta prevalans yöntemi ile değerlendirildi. Veriler daha önceden hazırlanmış formlara kaydedildi. Antibiyotik kullanım uygunluğu, hastanın antibiyotik kullanma nedeninin uygun olup olmamasına, seçilen antibiyotiğin spektrumuna, dozuna, doz aralığına ve kullanım süresine göre değerlendirildi.

Bulgular: Çalışmanın yapıldığı gün hastanede yatan 666 hastanın 262'si (%39,7) antibiyotik kullanıyordu. Antibiyotik alan hastaların 145'i (%55,3) cerrahi kliniklerde, 98'i (%37,4) dahili kliniklerde, 19'u (%7,3) ise çocuk kliniğinde yatıyordu. Bu 262 hastanın 157'sinin (%59,9) tek, 79'unun (%30,2) iki, 26'sının (%9,9) üç veya daha fazla sayıda antibiyotik kullandığı saptandı. Antibiyotik kullanımı hastaların %55,7'sinde (146 hasta) uygun olmasına rağmen, %44,3'ünde (116 hasta) uygun değildi. Uygunsuz antibiyotik kullanım oranı cerrahi kliniklerde yatan hastalar arasında %75,9 (88 hasta) idi. Profilaksi süresinin gereğinden fazla uzun tutulması cerrahi kliniklerde saptanan en sık uygunsuz

kullanım nedeni (%68,2, 60 hasta) idi. Dahili kliniklerde ise yatan 98 hastanın 24'ünde (%24,5) uygunsuz antibiyotik kullanımı tespit edildi. Kullanım nedenleri göz önüne alındığında %36,2'sinin (95 hasta) enfeksiyon tanısına yönelik, %35,9'unun (94 hasta) profilaktik, %27,9'u (73 hasta) ampirik olduğu gözlemlendi. Çalışmanın yapıldığı tarihte 262 hastaya toplam 367 adet antimikrobiyal ilacın reçete edildiği, en sık reçete edilen antibiyotiklerin ise sırasıyla sefalosporin (n=99, %27,0) ve kinolon (n=74, %20,2) grubu antibiyotiklerdi. Enfeksiyon tanısına yönelik olarak antibiyotik alan 95 hastanın tanılarına bakıldığında en sık alt solunum yolu enfeksiyonu (n=36, %37,9), ikinci sıklıkla üriner sistem enfeksiyonu (n=12, %12,6), daha sonra sırasıyla üst solunum yolu enfeksiyonu (n=8, %8,4), kan dolaşımı enfeksiyonu (n=6, %6,3) ve protez enfeksiyonu (n=6, %6,3) olduğu görüldü.

Sonuç: Cerrahi kliniklerde uygunsuz antibiyotik kullanımı yüksektir. Bu uygunsuz kullanım özellikle profilaksi süresi ile ilişkilidir. Bu nedenle cerrahların profilaktik antibiyotik kullanımı konusunda tekrar bilgilendirilmesi ve cerrahi profilaksi kılavuzlarına bağlı kalmalarının sağlanması uygun olacaktır. Ayrıca antibiyotik kullanımına yönelik nokta prevalans çalışmalarının web tabanlı ulusal veri ağı aracılığı ile belirli periyotlarla yapılmasının hatalı antibiyotik kullanılmasının tespiti ve bu hatalara yönelik çözüm yollarının belirlenmesi açısından yararlı olacaktır.

Anahtar Kelimeler: Prevalans, antibiyotik, hastane Nobel Med 2013; 9(3): 98-103

INTRODUCTION

Antibiotics are the most commonly prescribed drug group worldwide.^{1,2} The most important developments that have occurred in medical treatment during the last hundred years were those regarding antibiotics.³ However, the successes in treating illness with antibiotics have also resulted in unnecessary and random antibiotic use.⁴ Many studies clearly show that with the rise of antibiotic usage, an increase in resistance has arisen.²⁻⁵ Although resistance in pathogens has increased, unfortunately no new antibiotics that can overcome this resistance have been introduced and are not expected to be introduced in the near future.⁶ The unnecessary and inappropriate use of antibiotics leads to the failure of treatment by inducing antibiotic resistance and increasing the frequency of side effects. Consequently, besides mortality and morbidity, treatment costs are also increased.^{2,7} Antibiotics are a serious matter in developing countries, and resources that can be used to prevent this rise of resistance and limit the extent of this problem are in short supply.⁸⁻¹⁰ In addition to studies on inappropriate antibiotic

usage, the determination of appropriate antibiotic usage in light of laboratory and clinical findings may provide detailed data regarding antibiotic prescribing practices. In cases where the number of such detailed studies is insufficient, questionnaire studies on the appropriateness of indications for antibiotic usage may help to determine antibiotic policies and priorities in countries where the number of qualified personnel and financial resources are limited. Thus, point prevalence studies may provide helpful data on antibiotic prescribing habits.¹¹ This study aimed to determine the antibiotic usage rates in one hospital, the causes of antibiotics usage, the distribution of types of antibiotics used according to clinic, and inappropriate usage rates.

MATERIAL and METHOD

The study assessed antibiotic usage of inpatients being treated in Gulhane Military Medical Academy, which has a 1,200-bed capacity, on April 20, 2012, using the point prevalence method. Information such as demographic features, the wards on which the →

Table 1: Distribution of patients on antibiotics according to gender*

Gender	On antibiotics		Not on antibiotics		Total	
	n	%	n	%	n	%
Female	79	30.2	147	36.4	226	33.9
Male	183	69.8	257	63.6	440	66.1
Total	262		404		666	

* shown by column percentage

Table 2: Distribution of antibiotic usage status of patients according to clinics*

Clinic	On antibiotics		Not on antibiotics		Total		p
	n	%	n	%	n	%	
Surgical Wards	145	57.8	106	42.2	251	100.0	<0.001
Medical Wards	98	24.9	296	75.1	394	100.0	
Paediatric Wards	19	90.5	2	9.5	21	100.0	
Total	262		404		666		

* shown by row percentage

Table 3: Appropriateness status of antibiotic usage by indication

Indication	Appropriate		Inappropriate		Total	
	n	%	n	%	n	%
Infection Diagnosis	80	84.2	15	15.8	95	100.0
Prophylaxis	31	33.0	63	67.0	94	100.0
Empirical	35	48.0	38	52.0	73	100.0
Total	146 (55.7%)		116 (44.3%)		262 (100.0%)	

Table 4: Distribution of the cause of antibiotic usage by clinic*

Clinics	Empirical		Prophylactic		Infection Diagnosis		Total	
	n	%	n	%	n	%	n	%
Surgical Wards	30	20.7	88	60.7	27	18.6	145	100.0
Medical Wards	36	36.7	3	3.1	59	60.2	98	100.0
Paediatric Wards	7	36.8	3	15.8	9	47.4	19	100.0

* shown by row percentage

Table 5: Appropriateness of antibiotics usage by clinics and indications*

		Empirical	Prophylactic	Infection Diagnosis
		Surgery	Appropriate n (%)	4 (13.3)
	Inappropriate n (%)	26 (86.7)	60 (68.2)	2 (7.7)
Internal Medicine	Appropriate n (%)	26 (72.2)	2 (66.7)	46 (78.0)
	Inappropriate n (%)	10 (27.8)	1 (33.3)	13 (22.0)
Paediatric	Appropriate n (%)	5 (71.4)	1 (37.3)	9 (100.0)
	Inappropriate n (%)	2 (28.6)	2 (66.7)	-
Total n		73	94	95
p		<0.001	0.470	0.097

* shown by row percentage

patients were treated, admission indications, antibiotic usage status, antibiotic usage indications, name of

the antimicrobial agent used, dose frequency, length of antibiotic usage, existence of infectious disease consultation, culture results and place infection acquired (hospital or community) for all patients were recorded on pre-prepared forms. For filling out the forms, we used information gained from patient files and from the treating clinicians and nurses.

The appropriateness of the antibiotics used was assessed based on appropriateness of antibiotic usage for the patient's indications, spectrum of the antibiotic selected, dosage, dose frequency and duration of antibiotic usage. The assessment was carried out by an infectious disease specialist relying on the basic principles of antibiotic usage and current antimicrobial treatment guides. The causes of antibiotic usage were classified under three groups, namely, empirical, infection diagnosis and prophylactic. We used the following criteria for group definitions: i) Empirical-patients showing infection symptoms and findings, but still awaiting culture results for final diagnosis; ii) Infection diagnosis-patients treated based on culture results and clinically documented but having a negative culture result or no result at all; and iii) Prophylactic-patients having no infection but being treated to prevent development of a possible infection.

Data on forms were transferred to computer and analysed using SPSS (Statistical Package for the Social Sciences) 15.0. We used the chi square method for comparisons of categorical variables. *p* values <0.05 were considered to be statistically significant.

RESULTS

On the day this point prevalence study was performed, the number of patients in the hospital was 666, and 262 of those (39.7%) were on one or more antibiotics. Antibiotic usage status and gender of patients are given in Table 1. We failed to find any significant relation between gender and antibiotic usage (*p*=0.097).

Of patients on antibiotics, 145 were on surgical wards, 98 were on medical wards and 19 were on paediatric wards. Distribution of antibiotic usage status of patients according to clinic is given in Table 2. We found a statistically significant difference between being on antibiotics and not being on antibiotics for all clinics (*p*<0.001). The rates for patients on surgical and paediatric wards were 57.8% and 90.5%, respectively, and 24.9% for the patients on medical wards.

Of the patients on antibiotics, 157 (59.9%) were using one antibiotic, 79 (30.2%) were using two antibiotics and 26 (9.9%) were using three or more antibiotics. Appropriate usage of antibiotics was →

measured at 55.7% (146 patients) and inappropriate usage at 44.3% (116 patients). Causes of antibiotic usage were assessed under three categories, namely, empirical, prophylactic and infection diagnosis. The causes of antibiotics usage and the appropriateness of usage are summarized in Table 3. When the distribution of antibiotic usage according to cause was analysed, it was found that the most common usage was for prophylactic and infection diagnosis. The most common reason why antibiotics were used inappropriately was prophylaxis (54.3%, 63/116). It was found that antibiotic usage by 15 patients with an infection diagnosis was inappropriate. There was no consultation with infectious disease specialist for any of those patients, and the antibiotics used by those patients were not agents that would have been prescribed by an infectious disease specialist. Antibiotics most commonly used were oral quinolones (53%).

Distribution of antibiotic usage by cause is given in Table 4. It was found that antibiotics were mostly (61.4%) being used for prophylactic purposes on surgical wards. The most common cause of antibiotic usage on medical and paediatric wards was infection diagnosis.

Distribution of the appropriateness of antibiotic usage by clinic and indication are summarized in Table 5. When the cause was empirical, antibiotics were being used appropriately on medical and paediatric wards statistically significantly more than on surgical wards ($p < 0.001$). As the number of antibiotic usage based on prophylaxis was very limited on medical and paediatric wards, it awaits further analysis. On surgical wards, where prophylaxis is commonly used, the appropriateness rate was 32.6%. Overall appropriateness for antibiotic usage in cases of infection diagnosis was 84.2%. It was 100% for the paediatric wards, 92.3% for surgical wards and 78% for medical wards, but no statistical difference was found between them.

The distribution of clinical diagnosis for the 95 patients using drugs based on infection diagnosis on the day of study is given in Table 6. Of those 95 patients, 17 had infections with hospital origins and the cultures of 18 patients showed proliferation. Of those patients with a positive culture, 6 had been treated for urinary system infection, 4 for surgical wound infection and 2 for bloodstream infection.

On the day of the study, 367 antimicrobial drugs were prescribed to 262 patients in the hospital. Distribution of prescribed antibiotics by group is given in Table 7. When assessed based on preparation, the most commonly prescribed antibiotics were cefazolin

Table 6: Type of infection diagnosis for which antibiotic treatment was started

Infection Diagnosis	n	%
Lower Respiratory Tract Infection	36	37.9
Urinary System Infection	12	12.6
Upper Respiratory Tract Infection	8	8.4
Bloodstream Infection	6	6.3
Prosthesis Infection	6	6.3
Brucellosis	5	5.3
Surgical Wound Infection	4	4.2
Diabetic Foot Infection	3	3.2
Skin Soft Tissue Infection	3	3.2
Osteomyelitis	2	2.1
Other	10	10.5
Total	95	100.0

Table 7: Distribution of prescribed antibiotics by group

Antimicrobial	n	%
Cephalosporin	99	27.0
Quinolone	74	20.2
Beta-lactam + Beta-lactamase inhibitors	45	12.3
Anaerobic (Metronidazole, Ornidazole)	28	7.6
Carbapenem	25	6.8
Antifungal	19	5.2
Glycopeptide	14	3.8
TMP-SXT	13	3.5
Antiviral	13	3.5
Macrolide	12	3.3
Rifampicin	7	1.9
Aminoglycoside	5	1.4
Tetracycline	5	1.4
Daptomycin	3	0.8
Linezolid	3	0.8
Colistin	2	0.5
Total	367	100.0

sodium (n=66, 18%), ciprofloxacin (n=42, 11.2%), piperacillin-tazobactam (n=25, 6.8%) and cefuroxime axetil (n=22, 6%).

Distribution of selected antibiotics by cause of use is summarized in Table 8. It is remarkable that of the antibiotics selected for prophylactic use, 23.2% came from the quinolone group and all of these were oral forms not under control. It is also remarkable that the preferred antibiotics for treatment of infections are usually from the beta-lactam + beta-lactamase inhibitor group, with carbapenems third in line.

DISCUSSION

Today antibiotics are one of the most preferred treatment alternatives in general clinical practice. →

Table 8: Distribution of selected antibiotics by cause of use		
Empirical (n=73) 27.9%	n	%
Quinolones	20/73	27.4
Cephalosporins	17/73	23.3
Beta-lactam + β -lactamase inhibitors	11/73	15.1
Others	25/73	34.2
Prophylactic (n=94) 35.9%		
Cephalosporins	66/94	69.5
Quinolones	22/94	23.2
Others	6/94	7.3
Infection diagnosis (n=95) 36.3%		
Beta-lactam + Beta-lactamase inhibitors	23/95	24.5
Quinolones	20/95	21.3
Cephalosporins	14/95	14.9
Carbapenems	14/95	14.9
Others	23/95	34.5

Table 9: Results of point prevalence studies					
Study	Sample Size	Number of Patients on Antibiotics n (%)	Rate of Inappropriate Usage n (%)	Most Common Cause of Inappropriate Usage (%)	Most Commonly Used Antibiotics
Thu et al. ¹	7571	5104 (67.4)	1573 (30.8)	Prophylaxis	Cephalosporins
Ceyhan et al. ²	1302	711 (54.6)	332 (46.7)	Wrong indication, drug choice and dosage	Cephalosporins
Curcio et al. ¹³	1644	688 (41.8)	-	-	Carbapenems
Yılmaz et al. ¹⁴	422	153 (36.2)	84 (54.3)	Prophylaxis	1 st generation Cephalosporins
Ertuğrul et al. ¹⁵	70	38 (54.3)	26 (68.0)	Prophylaxis (50)	Cefazolin
Yıldırım et al. ¹⁶	226	104 (50.4)	29 (27.8)	Empirical usage (62.1)	-
Saçar et al. ¹⁷	545	299 (55)	57 (19.0)	Prophylaxis (12.0)	Ampicillin-sulbactam
Devrim et al. ¹⁸	212	134 (63.2)	97 (72.4)	Wrong choice of drug (32.8)	Ampicillin-sulbactam
Robert et al. ¹⁹	3964	1619 (40.9)	446 (27.5)	Unnecessarily long use of antibiotics	Beta-lactam + Beta-lactamase inhibitor
Usluer et al. ²⁰	9471	2900 (30.6)	1151 (42.8)*	Prophylaxis (47.3)	3 rd generation Cephalosporins
This study	666	262 (39.7)	116 (44.3)	Prophylaxis (54.3)	Cephalosporins

* Appropriateness statuses of 264 patients were not recorded.

As in other treatment modalities, antibiotic choices must be customized to the individual patient. Antibiotics are usually used for three basic purposes, namely empirical, prophylactic or diagnosed infection.¹²

Results of various point prevalence studies performed worldwide and in our country are summarized in Table 9.^{1-2,13-20} According to these data, antibiotic usage rates of inpatients varied between 36.2% and 67.4%. Our study found an antibiotic usage rate of 39.7%. The relatively low rate of antibiotic usage found in this study may be attributed to the effective

efforts of the antibiotics control committee of our hospital and the consultation provided by infectious disease specialists.

Similarly, the inappropriate antibiotic usage rates reported in the above-mentioned studies varied between 19.0% and 72.4% and was 44.3% in our study. It is a worrying fact that almost half of antibiotherapies are inappropriate even in our hospital with such a relatively low usage rate. When causes of inappropriate usage are assessed, they consist of unnecessarily prolonged use and aimless prophylaxis and empirical applications. In our study, prophylaxis was the most common cause of inappropriate usage, with a rate of 54.3%. We found that antibiotherapy treatments started on surgical wards for prophylactic purposes are usually used for unnecessarily prolonged durations and in addition, inappropriate drugs were used. The rate of oral quinolones used for prophylactic purposes was 23.2%, yet the existing guidelines do not include the direct use of oral quinolones for prophylactic purposes.^{21,22} It is important for surgeons to be informed on prophylaxis and warned to stick with surgical prophylaxis guidelines.

In a study performed by Latour et al., antibiotics used by 1,966 patients treated in 323 different facilities in 21 European countries were analysed.²³ Most of the data obtained came from the web-based ESAC (European Surveillance of Antimicrobial Consumption). It was found that the cause of antibiotic usage was empirical in 54.4% of cases and prophylactic in 28.8% of cases. Significant differences were found between countries in terms of cause of antibiotic usage. This study determined uroprophylaxis to be the most common cause, although differences exist between countries. In a multicentre study conducted on hospitalised patients, Usluer et al. reported the most common causes of antibiotic usage to be lower respiratory tract, urinary system and surgical wound infections.²⁰ Our study also found the most common causes to be lower respiratory tract infections, then urinary system infections. Consistent with the study of Usluer et al., our study found that the most prescribed agents were antibiotics from cephalosporin group.²⁰

CONCLUSION

In developing countries such as ours, rational antibiotic usage policies must be developed in order to prevent an increase in both resistance and costs.¹⁵ To this end, combining all point prevalence studies on antibiotic usage to a single centre via a web-based national database and repeating such studies periodically would be very helpful for determining errors in antibiotic usage and developing solutions.

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