Original Investigation *doi: 10.5455/medscience.2014.03.8246*

Evaluation of the Practice of Antibiotic Prophylaxis in a State Hospital

Yavuz Orak[1], Sultan Akkus[2], Filiz Orak[3], Aynur Suner[4]

[1] Department of Anesthesiology and Reanimation, Mardin State Hospital, Mardin.

[2] Department of Pharmacy, Mardin State Hospital, Mardin.

[3] Department of Medical Microbiology, Elitpark Private Hospital, Çorum.

[4] Department of Infectious Diseases and Clinical Microbiology, Mardin State Hospital, Mardin

Abstract

In terms of antibiotic prophylaxis in surgical patients, incorrect application in hospitals is still one of the most frequently made errors in the medical practice. Surgical site infections, with a rate of 15%-18%, are seen as the second most prevalent of all nosocomial infections.The aim of our study was to investigate the use of antibiotics implemented in surgical prophylaxis. The study was conducted on 180 patients on whom elective surgery was performed in Mardin State Hospital between the dates of September 1 and December 31, 2013. Drug distribution was made according to age, gender, risk factors for surgical site infection; ASA (American Society of Anesthesiologists) score, the name of the prophylactic antibiotics used, clinics distribution, and wound classification. Our study determined that in 71.7% of the cases, prophylaxis was given in incorrect doses; that it was continued for too long a period in 56.2%; and that an inappropriate antibiotic had been selected in 51.7%. It has become more important for the infection control committee to not only create a guide, but also to periodically update training in coordination with anesthesiologists and surgical specialists and take necessary measures. The contribution of the clinical pharmacy practice to the solution of this problem must be discussed.

Keywords: Antibiotics, surgery, clinical pharmacy, prophylaxis

(Rec.Date: Dec 15, 2014 Accept Date: Jan 19, 2015)

Corresponding Author*:* Filiz Orak, Department of Medical Microbiology, Elitpark Private Hospital, Çorum, Turkey
E-mail: drfilizorak@hotmail.com

Introduction

Antibiotics are the most commonly used drugs in the world. However, they are too often used unnecessarily or incorrectly. Excessive or improper use of antibiotics has brought about growing antibacterial resistance in microorganisms, treatment failures, increasingly frequent side effects, a rise in morbidity and mortality, and a climb in the cost of treatment [1,2]. The incorrect application of antibiotic prophylaxis in hospital surgical patients continues to be one of the most commonly made errors in the practice of medicine [3]. The prevention of infection following surgery reduces postoperative infectious morbidity and mortality, length of hospital stay, and costs [4]. The aim of the very brief use of antibiotics in surgical prophylaxis known as administration of antibiotics, begun just before surgery, is to provide support to lower the microbial load level related to the contamination that will arise during the operation, which would exceed the host defenses [5]. Surgical site infections, with a rate of 15%-18%, are seen as the second most prevalent of all nosocomial infections. The goal of our study, which we conducted at Mardin State Hospital, was to examine the antibiotics used in preoperative surgical prophylaxis, to determine their suitability to the literature, and to prepare appropriate guidelines for our hospital.

Materials and Methods

The study was conducted on 180 patients on whom elective surgery was performed in Mardin State Hospital between the dates of September 1 and December 31, 2013. After obtaining approval from the Chief Physician, services were visited daily and data were recorded concerning the patient and the surgical prophylaxis applied. Drug distribution was accomplished according to age, gender, risk factors for the surgical site, ASA (American Society of Anesthesiologists) score, name of the prophylactic antibiotic used, clinic distribution, and wound classification. Drugs were distributed to be used in the patients' postoperative antibiotic therapy. Diabetic patients were recorded who had acceptable risk of liver and kidney failure. Emergent cases were not included in the study. The average postoperative stay was calculated. Data obtained were analyzed according to the hospital's surgical prophylaxis guidelines, which had previously been prepared in light of the information in the "Guideline for Prevention of Surgical Site Infection" published by the

American Journal of Surgery [7]. Perioperative antibiotic prophylaxis (PAP) patients were evaluated according to the following criteria:

1. If a prosthesis is not inserted, SP (surgical prophylaxis) performed during an operation is considered "improper use". In clean-contaminated and contaminated operations, application of SP is deemed to be "proper use".

2. Antibiotics to be used must be of the narrowest spectrum, of low toxicity, effective against the target microorganisms, bactericidal, reliable, and inexpensive. Accordingly, the use of first- or second-generation cephalosporins is deemed to be sufficient. The implementation of broader-spectrum antibiotics is considered "improper use".

3. The administration of a single dose of antibiotics either during or 30-45 minutes prior to the induction of anesthesia is considered "proper use". Prophylaxis lasting longer than 24 hours or beginning one to two days before the operation is deemed "improper use" [8].

ASA (American Society of Anesthesiologists) Classification

This is a useful evaluation system for preoperatively classifying patients and identifying appropriate anesthetic approaches and monitoring methods.

ASA 1: A normal, healthy person; a patient with no organic pathology; or a patient whose pathology is local and not the cause of any systemic disorder.

ASA 2: A person with a mild systemic disorder related either to a required surgical intervention or to another existing pathological process (e.g., mild anemia, chronic bronchitis, hypertension, emphysema, obesity, or diabetes).

ASA 3: A person with a disease that limits her activity but does not weaken her (e.g., hypervolemia, latent heart failure, myocardial infarction, advanced diabetes, or limiting lung function).

ASA 4: A person with a pathology that has completely incapacitated her or which poses a continuous threat to her life (e.g., shock, decompensated cardiac or respiratory diseases, or kidney or liver failure).

ASA 5: A person for whom surgical intervention is her last hope, or one who is not expected to survive longer than 24 hours, with or without surgery.

ASA 6: A person who is brain dead, for whom organ harvesting is appropriate.

Results

The average age of patients in the study was found to be 31.27 ±18.63 years. Of the patients, 63 (35%) were women and 117 (65%) were men. Underlying diseases were detected in three patients: liver failure in one and chronic renal disease (CRD) in the other two. When analyzed according to ASA scores, 149 patients were found to be ASA 1, 29 were ASA 2, and two were ASA 3. The distribution of wound classifications was found to be: 151 patients with clean, 27 with clean-contaminated, and two with contaminated wounds (Table 1). The distribution of patients according to surgical wards is given in Table 2.

Table 1: Preoperative distribution of patients and risk factors

		N	(%)
Underlying diseases			
	CRD	2	(1.1)
	LF	1	(0.6)
ASA score			
	ASA 1	149	(82.8)
	ASA 2	29	(16.1)
	ASA 3	2	(1.1)
Wound classification			
	Clean	151	(83.9)
	Clean-contaminated	27	(15.0)
	Contaminated	2	(1.1)
	Dirty	0	

CRD: chronic renal disease; LF: liver failure; ASA: American Society of Anesthesiologists

No SSP application error was observed in only eight (4.4%) of the 180 surgeries studied. When the choice of antibiotics, their dosage, and the duration of the prophylaxis of the remaining 172 patients were evaluated, one or more of these three parameters were found to be inappropriate. It was determined that in 71.7% of the cases, an incorrect dose of the prophylaxis was administered; in 56.2%, prophylaxis was continued for longer than necessary; and in 51.7%, the wrong antibiotic was selected (Table 3). It was discovered that

the average duration of postoperative prophylaxis was 2.44 days for cefazolin and 2.02 days for metronidazole.

Table 2: Distribution of patients according to surgery clinics

	n	**%**
ENT(ear nose and throat specialist)	45	24.9
Urology	45	24.9
General Surgery	45	24.9
Plastic Surgery	10	5.5
Neurosurgery	16	8.8
Cardiovascular Surgery	5	2.8
Orthopedics	15	8.3

Table 3: Suitability of ğrophylaxis for PAP Patients

	Correct		Incorrect	
	N	(%)	*N*	(%)
Choice of Antibiotic	87	(48.3)	93	(51.7)
Appropriateness of Dosage	44	(28.3)	136	(71.7)
Duration of Prophylaxis	79	(43.8)	101	(56.2)

The four classes of antibiotics most commonly used for the purpose of preoperative antibiotic prophylaxis (PAP) were found to be first-generation cephalosporins, second-generation cephalosporins, third-generation cephalosporins, and amoxicillin-clavulanate (Table 4). The most frequently administered antibiotics, according to the classification of the patients' surgical wounds, are provided in Table 5. It was observed that two antibiotics were used together in 28.3% (n = 52) of the cases, while three were used in 2.2% (n = 4). The antibiotic most commonly used in combination was found to be metronidazole.

Table 4: Distribution of Drugs Used for Preoperative Antibiotic Prophylaxis (PAP)

		n	**%**
PAP-1	Cefazolin	83	49.4
	Cefuroxime	50	29.8
	Ceftriaxone	22	13.1
	Amoxicillin + Clavulanate	12	7.1
	Cefoperazone+ Sulbactam	1	0.6
PAP-2	Metronidazole	41	78.8
	Gentamicin	10	19.2
	Ciprofloxacin	1	1.9
PAP-3	Gentamicin	4	100.0

Table 5: Percentages of Antibiotics Used for PAP, by Wound Classification

	Clean		Clean-Contaminated		Contaminated
	n	(%)	*n*	(%)	
1st Generation cephalosporins	75	(52.1)	4	(15.4)	0
2nd Generation cephalosporins	41	(28.5)	3	(11.5)	1
3rd Generation cephalosporins	11	(7.6)	12	(46.2)	1
Ampicillin Sulbactam	13	(1.4)	7	(26.2)	0

Discussion

The goal of surgical prophylaxis is to reduce bacterial flora, control any possible contamination, and minimize the incidence of surgical infections by providing appropriate tissue and serum levels during surgery. With the administration of antibiotics in the appropriate period, dose, and manner, prophylaxis reduces the total usage of antibiotics and shortens patients' hospital stays [9,10]. Antibiotic administration, either concurrent with the induction of anesthesia or in the preoperative period one hour prior to incision, provides sufficient levels of tissue and serum and inhibits both the intrusion of bacteria into the wound area and the development of infection. Many studies have determined that the administration of antibiotics in the early operative period or in the postoperative period has no benefit [11-13]. A study by Wittmann et al [14] proved that there was no difference in outcome between single-dose prophylaxis and a five-day administration of antibiotics, and later research in the literature supports this finding [12].

In our study, it was found that protracted prophylaxis was performed 56.2% of the time. A relationship was found between postoperative antibiotic use lasting longer than 24 hours and the development of surgical site infection associated with methicillin-resistant *S. aureus* (MRSA) [15].

In our study, it was discovered that the most frequently made error, at 71.7%, was incorrect dosage. Additional doses may be administered in operations lasting in excess of three hours. Additional doses may also be administered during the operation in cases of heavy bleeding. It is recommended that the duration of prophylaxis not exceed 24 hours [16]. However, the tendency of surgeons to administer antibiotics for an extended period postoperatively has become common practice [8]. Most surgeons believe that infection will not develop in patients with antibiotic pressure and so prolong the prophylaxis period [17].

Second- and third-generation cephalosporins have been shown to be superior to first-generation cephalosporins [10].However, our study revealed that of the surgeries evaluated,an inappropriate antibiotic was chosen in 51.7%,combination therapy was performed on 31.1%, 24 patients underwent prophylaxis with third-generation cephalosporins, and Cefoperazone Sulbactam was used on one patient. Another study found the use of wide-spectrum antibiotics to be 69% [17]. In a study performed in our country, it was determined that the antibiotics most commonly used in prophylaxis were first-generation cephalosporins (27%), ampicillin-Sulbactam (21%), and gentamicin (19.1%). In the course of this study, it was found that 43 (17.2%) applications of prophylaxis were entirely appropriate while 207 (82.8%) were not.The prophylaxis in 82.8% of the cases was found to have lasted too long and in 66.4% to have been started at the wrong time. Furthermore, faulty practices were found related to choice of antibiotics (66.4%), patient selection (13.2%), method of administration (12.4%), and dosage (5%). Insufficient knowledge, anxiety, and inadequate local guidelines of the hospitals were put forward as the main causes of the mistakes made in application. With the exception of several negative results, it is a well-known fact that the unnecessary and improper use of antibiotics has contributed significantly to the development of antimicrobial resistance [18]. In a multicenter study performed by Hoşoğlu et al, 88% of those administered surgical prophylaxis received multiple doses rather than a single dose, 46% experienced prophylaxis lasting longer than 48 hours, 32% were given incorrect antibiotics, and for 39% the time of application was wrong [19].

PAP guidelines are prepared in every hospital and standardized by the infection control committee. Although there are differences between the guides of various hospitals, it also appears that there has been some lack of compliance with the guides. It is important that the infection control committee not only draw up the guidelines but also update the training at intervals with the coordination of the anesthesiologists and the surgical branch specialists. Additionally, discussion and further studies are recommended to determine whether clinical pharmacy practices contribute to solving this problem in our country.

References

1. Tünger O, Dinç G, Özbakkaloğlu B, Atman UC, Algun U: Evaluation of rational antibiotic use. Int J Antimicrob Agents. 200;15(2):131-5.
2. Çakır N: Rasyonel olmayan antibiyotik kullanımının ekonomik sonuçları. Klimik Derg. 2001;14:35-40.
3. Burke JP: Maximizing appropriate antibiotic prophylaxis for surgical patients: An update from LDS Hospital, Salt Lake City. Clin Infect Dis. 2001;33(Suppl 2):S78-83.
4. Raşa K, Çakmakçı M: Ameliyatlarda profilaktik antibiyotik kullanımı. In: Doğanay M, Ünal S, eds, Hastane İnfeksiyonları. Ankara: Bilimsel Tıp Yayınevi, 2003;663-81.
5. Özkurt Z, Kadanalı A, Ertek M, Erol S, Parlak M. Cerrahi Profilakside Antibiyotik Kullanımı. Ankem Derg. 2005;19(3):111-4.
6. Frighetto L, Marra CA, Stiver HG, Bryce EA, Jewesson PJ. Economic impact of standardized orders for antimicrobial prophylaxis program. Ann Pharmacother. 2000;34(2):154-60.
7. Bratzler DW, Houck PM. Surgical Infection Prevention Guideline Writers Workgroup. Antimicrobial prophylaxis for surgery: an advisory statement from the National Surgical Infection Prevention Project. Am J Surg. 2005;189(4):395-404.
8. Hoşoğlu S: Cerrahi profilakside problemler ve sistemimizdeki uygulamalar. ANKEM Derg. 2004;18(Ek 2):185-7.
9. Thomas R. Surgical site infections and antimicrobial prophylaxis. In: Mandell GL, Douglas RG, Bennett JE, eds, Principles and Practice of Infectious Diseases, 7th edition. New York: Chuchill Livingstone, 2009;3891-904.
10. Dökmetaş İ. Cerrahide profilaktik antibiyotik kullanımı. Klimik Derg. 2001;14(3):135-39.
11. Shuman EK, Urquhart A, Malani PN. Management and prevention of prosthetic joint infection. Infect Dis Clin North Am. 2012;26(1):29-39.
12. Enzler MJ, Berbari E, Osmon DR. Antimicrobial prophylaxis in adults. Mayo Clin Proc. 2011;86(7):686-701.

13. van Kasteren ME, Manniën J, Ott A, Kullberg BJ, de Boer AS, Gyssens IC. Antibiotic prophylaxis and the risk of surgical site infections following total hip arthroplasty: timely administration is the most important factor. Clin Infect Dis. 2007;44(7):921-27.
14. Wittmann DH, Schein M. Let us shorten antibiotic prophylaxis and therapy in surgery. Am J Surg. 1996;172(6A):26S-32S.
15. Surgical Site Infections Associated with Methicillin-Resistant Staphylococcus aureus: Do Postoperative Factors Play a Role? CID. 2003;36(7):863-8.
16. http://www.ataturkhastanesi.gov.tr/Bilgilendirme/Dokumanlari/Talimatlar14.pdf access date 01.12.2014
17. Tuna N, Öğütlü A, Sandıkçı Ö, Ceylan S, Gözdaş HT, Altıntoprak F, Karabay FO. Bir araştirma hastanesinde cerrahi profilaksi uygulamalarinin gözden geçirilmesi ANKEM Derg. 2010;24(2):92-5.
18. Harbarth S, Samore MH, Lichtenberg D, Carmeli Y. Prolonged antibiotic prophylaxis after cardiovascular surgery and its effect on surgical site infections and antimicrobial resistance. Circulation. 2000;101(25):2916-21.
19. Hosoglu S, Sunbul M, Erol S, Altindis M, Caylan R, Demirdag K, Ucmak H, Mendes H, Geyik MF, Turgut H, Gundes S, Doyuk EK, Aldemir M, Dokucu AI. Anational survey of surgical antibiotic prophylaxis in Turkey. Infect Control Hosp Epidemiol. 2003;24(10):758-61.