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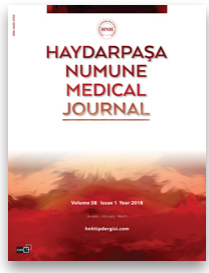

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ORIGINAL ARTICLE

Evaluation of Surgical Prophylactic Antibiotic Use in a Tertiary Care Hospital

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Abstract

Introduction: Antibiotic prophylaxis is one of the basic practices to prevent surgical site infections. For rational surgical prophylaxis, the right antibiotic should be given in the right dose at the right time. In this study, we aimed to evaluate the compliance of antibiotic use for surgical prophylaxis in our hospital with the guidelines for surgical antibiotic prophylaxis.

Methods: Adult patients who underwent surgery in eight different surgical clinics of İzmir Health Sciences University Tepecik Training and Research Hospital between 20.01.2021 and 20.01.2023 were included in the study. The prophylactic antibiotics administered to these patients were retrospectively analyzed in terms of content, timing of administration, dose, and duration of use and evaluated for compliance with the surgical prophylaxis guidelines of our hospital.

Results: A total of 1,379 patients were included in the study. The most common reasons for noncompliance were prolonged prophylaxis, incomplete prophylaxis, and wrong choice of antibiotic. The neurosurgery clinic was the most compliant clinic, while the cardiovascular surgery clinic was the most non-compliant clinic. It was statistically significant that the use of the surgical prophylaxis guideline was higher in the group given antibiotics compared to those not given antibiotics ($p<0.001$).

Discussion and Conclusion: It was observed that persuasive activities are needed to convince patients that full compliance with the surgical prophylaxis guideline is important for both safe surgery and rational antibiotic use, especially the abandonment of prolonged prophylaxis.

Keywords: Antibiotics; prophylaxis; surgery.

Although surgery is an important area of medicine, postoperative infections can cause serious health problems[1]. These infections can both prolong the patient's recovery process and increase morbidity and mortality. Infections, especially in the postoperative period, can negatively affect the patient's health status and increase treatment costs[2].

Antibiotic prophylaxis is a fundamental strategy to prevent surgical site infections. Administration of the right antibiotic at the right time and dose is critical to reducing surgical site infections[3]. Prophylactic antibiotic use can provide a protective barrier against potentially pathogenic microorganisms during surgery and reduce the risk of infection.

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However, antibiotic use alone is not sufficient for rational surgical prophylaxis. In addition, factors such as the choice of antibiotic, timing of administration, dose, and duration of use should be carefully determined[4,5]. Misapplication or inappropriate use of these factors may contribute to the development of antibiotic resistance and make it difficult to control infections[6].

Therefore, evaluating the effectiveness and appropriateness of antibiotic use during surgical prophylaxis is an important step in the prevention of surgical site infections. This study aims to evaluate the appropriateness of antibiotic use for surgical prophylaxis according to the surgical antibiotic prophylaxis guidelines of a tertiary care hospital. This evaluation will be an important step in reducing the risk of surgical site infection and ensuring patient safety.

Materials and Methods

Study Setting and Design

Patients who underwent surgery in eight different surgical clinics of İzmir Health Sciences University (HSU) Tepecik Training and Research Hospital between 20.01.2021 and 20.01.2023 were included in the study. The prophylactic antibiotics administered to these patients were retrospectively analyzed in terms of content, timing of administration, dose, and duration of use and evaluated for compliance with the surgical prophylaxis guidelines of our hospital.

Study Definitions and Variables

Based on the definitions in the national surgical guidelines, surgeries performed in neurosurgery, gynecology and obstetrics, pediatric surgery, otolaryngology, orthopedics, urology, general surgery, and cardiovascular surgery clinics, and antimicrobial prophylaxis given were retrospectively scanned from the hospital information system[7]. The reasons for non-compliance with antimicrobial prophylaxis were categorized as "prolonged prophylaxis, failure to give prophylaxis when necessary, failure to give an additional dose of antibiotic, early administration of antibiotic, late administration of antibiotic, wrong choice of antibiotic content"[8].

Statistical Analysis

Patient data collected in the study were analyzed using IBM Statistical Package for the Social Sciences (SPSS) for MacOS 29.0 (IBM Corp., Armonk, NY). Frequency and percentage for categorical data and median (interquartile range) for continuous data were used as descriptive values. The Mann-Whitney U test was used for intergroup comparisons, and the chi-square or Fisher's exact test was used for comparisons of categorical variables. Results were considered statistically significant if the p-value was less than 0.05.

The study was approved by the Ethics Committee of Health Sciences University İzmir Tepecik Training and Research Hospital on May 7, 2024, with decision number 2024/04-08. All procedures were performed in accordance with the ethical standards of the Human Experimentation Committee of our institution and the Declaration of Helsinki.

Results

The study included 1,379 patients, 675 (48.9%) women and 704 (51.1%) men. The mean age was 48.96±18.43 years. The mean operating time was 94.66±32.45 minutes. Prophylaxis was performed according to surgical prophylaxis guidelines in 33.1% (457/1,379) and inappropriately in 66.8% (922/1,379) of the patients. It was statistically significant that the use of surgical prophylaxis according to the surgical prophylaxis guideline was higher in the antibiotic group compared to the non-antibiotic group (p<0.001) (Table 1). Comparing the

Table 1. Distribution of patients with and without surgical prophylaxis guideline

	n (Total 1379)	%	p*
Antibiotic administered	**1087**	**78.8**	
Compliance with Surgical Prophylaxis Guideline	436	40.1	
Non-compliance with Surgical Prophylaxis Guideline	651	59.8	
No antibiotics administered	**292**	**21.1**	
Compliance with Surgical Prophylaxis Guideline	21	7.1	<0.001
Non-compliance with Surgical Prophylaxis Guideline	271	92.8	

*p value ≤0.05 is considered statistically significant.

Table 2. Clinic Compliance/Noncompliance Rates with Surgical Prophylaxis Guideline

Clinics	Compliant with Surgical Prophylaxis Guideline (%)	Non-Compliant with Surgical Prophylaxis Guideline (%)
Neurosurgery	90.7	9.3
Gynecology and Obstetrics	78.3	21.7
Pediatric Surgery	57	43
Otolaryngology	33.3	66.7
Orthopedics and Traumatology	24.2	75.8
Urology	16	84
General Surgery	13.5	86.5
Cardiovascular Surgery	12.4	87.6

Table 3. Factors Causing Non-Compliance with Surgical Prophylaxis Guideline

	Non-compliance in patients with/without antibiotics (n=922) % (n)	Non-compliance in patients with antibiotics (n=651) % (n)
Extended prophylaxis	38.5 (355)	54.5 (355)
Absence of antibiotic administration when prophylaxis is necessary	29.3 (271)	--
No additional dose	14.6 (135)	18.2 (119)
Early administration	10.7 (99)	15.2 (99)
Late administration	9.9 (92)	14.1 (92)
Choosing the wrong antibiotic ingredient	9.4 (87)	13.3 (87)

Some of the same cases may have "multiple reasons for noncompliance".

compliance of surgical prophylaxis between clinics, the most compliant clinic was the neurosurgery clinic with 90.7%, while the most non-compliant clinic was the cardiovascular surgery clinic (Table 2).

The reasons for non-compliance with the surgical prophylaxis guideline were: prolonged prophylaxis 36.3% (335), failure to give prophylaxis when prophylaxis was required 29.3% (271), failure to give additional doses in operations lasting longer than four hours 14.6% (135), failure to give additional doses in operations lasting longer than four hours 10.7% (108), antibiotics were started 24 hours before the incision 9.9% (92), antibiotics were not administered before the incision but after the operation 6.8% (63), and antibiotics were wrongly selected. The distribution of all these reasons for non-compliant prophylaxis in the antibiotic group is detailed in Table 3.

Discussion

In this study, the most common reason for non-compliance with surgical prophylaxis guidelines was the unnecessary continuation of antibiotics in the postoperative period. Non-compliance related to incorrect choice of antibiotic and timing of administration was less common. Similar to our findings, other studies have shown that the most common error in surgical prophylaxis was prolonging the duration of prophylaxis[9].

In 2003, the Budget Implementation Instruction introduced some restrictions by requiring the approval of an infectious disease specialist (IDS) for the use of broad-spectrum antibiotics[10]. Although inappropriate antibiotic use decreased after the implementation of the IDS, many studies have reported that errors in antibiotic selection, dose, and timing of administration persist[11-14].

In a study evaluating rational antibiotic use and costs, it was found that one-third of inappropriate antibiotic use was due to errors in surgical prophylaxis. Our antibiotic selection rate was higher than that reported in studies from other centers[15]. This may be due to the requirement for IDS approval of broad-spectrum antibiotics and the fact that the training was convincing in this regard.

Studies reporting that all inappropriate antibiotic use was for antibiotics that did not require IDS approval support that IDS approval is effective in reducing inappropriate antibiotic use[15,16].

The risk of developing a surgical site infection varies depending on the surgical technique, type of surgery,

patient comorbidities, and whether surgical prophylaxis is used. In our study, 119 operations lasting longer than 240 minutes did not require an additional dose. Timing is important in antimicrobial prophylaxis because adequate antibiotic levels in tissue and serum must be maintained at the time of incision for prophylaxis to be effective. It has been shown that antibiotics administered earlier than the specified time or in the postoperative period are insufficient to prevent surgical site infections, and the risk of surgical site infection increases with the time interval between preoperative antibiotic administration and incision[17].

Study Limitations

The study was cross-sectional, single-center, and therefore the results may not be generalizable due to the limited number of cases. Our study design was retrospective and based on available clinical documentation; our results may have been overestimated or underestimated due to the possibility of additional clinical factors not documented in the clinical records. In addition, our study did not report the rates of surgical site infection in patients with inappropriate surgical prophylaxis and the rates of postoperative infection in patients with appropriate antibiotic prophylaxis, which may be another limitation.

Conclusions

In the current era of antimicrobial resistance, rational surgical prophylaxis should be accepted as part of rational antibiotic use; it seems that persuasive efforts are needed to convince that full compliance with surgical prophylaxis guidelines, especially the abandonment of prolonged prophylaxis, is important for both safe surgery and rational antibiotic use.

Ethics Committee Approval: The study was approved by Health Sciences University İzmir Tepecik Training and Research Hospital Ethics Committee (No: 2024/04-08, Date: 07/05/2024).

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Conflict of Interest: The authors declare that there is no conflict of interest.

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References

1. Pinchera B, Buonomo AR, Schiano Moriello N, Scotto R, Villari R, Gentile I. Update on the management of surgical site infections. Antibiotics (Basel) 2022;11:1608.
2. National Healthcare Safety Network, Centers for Disease Control and Prevention. Surgical site infection [SSI]. Available at:http://www.cdc.gov/nhsn/pdfs/pscmanual/9pscssicurrent.pdf. Accessed Sep 1, 2022
3. Stewart S, Robertson C, Pan J, Kennedy S, Dancer S, Haahr L, et al. Epidemiology of healthcare-associated infection reported from a hospital-wide incidence study: Considerations for infection prevention and control planning. J Hosp Infect 2021;114:10–22.
4. Butt SZ, Ahmad M, Saeed H, Saleem Z, Javaid Z. Post-surgical antibiotic prophylaxis: Impact of pharmacist's educational intervention on appropriate use of antibiotics. J Infect Public Health 2019;12:854–60.
5. Bozok TS. Makrolidlerin ve linkozamidlerin etki spektrumu ve kullanım alanları. In: Odemis I, editor. Antibiyotiklere güncel ve çok yönlü yaklaşım. Ankara: Akademisyen Kitabevi; 2023. p.170–8. [In Turkish]
6. Wang Q, Cao M, Tao H, Fei Z, Huang X, Liang P, et al. Evidence-based guideline for the prevention and management of perioperative infection. J Evid Based Med 2023;16:50–67.
7. Sağlık Hizmetleri Genel Müdürlüğü Sağlıkta Kalite ve Akreditasyon Daire Başkanlığı. Güvenli cerrahi uygulama rehberi kitabı. Available at: https://shgmkalitedb.saglik.gov.tr/TR-12638/sks-rehberleri.html. Accessed Apr 10, 2023 [In Turkish]
8. Dyar OJ, Huttner B, Schouten J, Pulcini C; ESGAP (ESCMID Study Group for Antimicrobial stewardshiP). What is antimicrobial stewardship? Clin Microbiol Infect 2017;23:793–8.
9. Kaya S, Aktas S, Senbayrak S, Tekin R, Oztoprak N, Aksoy F, et al. An evaluation of surgical prophylaxis procedures in Turkey: A multi-center point prevalence study. Eurasian J Med 2016;48:24–8.
10. T.C. Resmi Gazete. Antibiyotik reçeteleme kuralları. Available at: https://www.resmigazete.gov.tr/eskiler/2003/02/20030201.htm. Accessed Apr 10, 2023. [In Turkish]
11. Karahocagil MK, Er A, Kırıkçı AD, Sünnetçioğlu M, Yapıcı K, Bilici A, et al. Yüzüncü Yıl üniversitesi Tıp fakültesi araştırma hastanesinde yatan hastalarda antibiyotik kullanımının incelenmesi. Van Med J [Article in Turkish] 2007;14:46–51.
12. Ertuğrul MB, Özğün H, Saylak MO, Sayım N. Bir üniversite hastanesi cerrahi servislerinde antibiyotik kullanımı ve maliyeti: Bir günlük nokta prevalansı çalışması. Klimik J [Article in Turkish] 2009;22:44–7.
13. Yılmaz G, Öztürk EM, Ayhan M, Coşkün B, Azap A. Bir üniversite hastanesindeki antibiyotik kullanımının araştırılması. Klimik J [Article in Turkish] 2014;27:109–13.
14. Azap A, Memikoğlu KO, Çokça F, Tekeli E. Bir üniversite hastanesinde bütçe uygulama talimatı öncesinde ve sonrasında antibiyotik kullanımı. Flora Derg [Article in Turkish]

2004;9:252–7.
15. Bozkurt F, Kaya S, Tekin R, Gulsun S, Deveci O, Dayan S, et al. Analysis of antimicrobial consumption and cost in a teaching hospital. J Infect Public Health 2014;7:161–9.
16. İnan A, Dağlı O, Şenbayrak Akçay S, Öztürk Engin D, Karağül E, Özyürek SÇ. Antibiotic use and cost in a teaching hospital in İstanbul. J Microbiol Infect Dis 2011;1:128–33.
17. Steinberg JP, Braun BI, Hellinger WC, Kusek L, Bozikis MR, Bush AJ, et al. Timing of antimicrobial prophylaxis and the risk of surgical site infections: Results from the trial to reduce antimicrobial prophylaxis errors. Ann Surg 2009;250:10–6.