

Original Article

## Assessment of prophylactic antibiotic usage habits of the general surgeons in Turkey

Cem Karaali<sup>1</sup>, Mustafa Emiroglu<sup>1</sup>, Huseyin Esin<sup>1</sup>, Ismail Sert<sup>1</sup>, Cengiz Aydın<sup>1</sup>, Sabri Atalay<sup>2</sup>, Sukran Kose<sup>2</sup>, Gokhan Akbulut<sup>3</sup>, Mehmet Burak Oztop<sup>4</sup>, Hedef Ozgun<sup>5</sup>

<sup>1</sup> Department of General Surgery, University of Health Sciences Tepecik Education and Research Hospital, Izmir, Turkey

<sup>2</sup> Department of Infectious Diseases, University of Health Sciences Tepecik Education and Research Hospital, Izmir, Turkey

<sup>3</sup> Department of General Surgery, Izmir Tınaztepe University Galen Hospital, Izmir, Turkey

<sup>4</sup> Izmir Provincial Health Directorate, Izmir, Turkey

<sup>5</sup> Department of General Surgery, Adnan Menderes University, Aydin, Turkey

### Abstract

**Introduction:** One of the most important aspects of inappropriate antibiotic use among general surgeons in Turkey is the use of surgical antibiotic prophylaxis (SP). In order to shed light on the current situation, we conducted a survey of general surgeons in our country. Our aim was to evaluate the approach taken by our general surgeons in prescribing SP, while providing data pertinent to the effectiveness of the ‘Rational Drug Use’ (AIK) national action plan.

**Methodology:** A questionnaire on the subject of personal SP usage and compliance with guidelines was distributed amongst general surgeons between 2018-2019. The questions related to individual approaches taken by surgeons when treating patients with either clean or clean-contaminated wounds. Results of the questionnaires were collated and compliance with ASHP guidelines was evaluated.

**Results:** A total of 317 completed questionnaires were evaluated. According to the questionnaire results, the rate of total compliance with ASHP guidelines was 26.8%. The compliance rate for preoperative SP was 69.7% in the clean wound group and 54.6% in the clean-contaminated wound group. Although 96.5% of the participants reported correct timing for the first dose of SP, this number dropped to 79.5% apropos the administration of further doses of prophylaxis. The percentage of surgeons prescribing continued antibiotics at discharge for clean and clean-contaminated cases was 22.7% and 38.5%, respectively.

**Conclusions:** The results of this study indicate that inappropriate use of SP is widespread in our country, and that antibiotics continue to be prescribed at discharge.

**Key words:** questionnaire; surgical antibiotic prophylaxis, national action plan, general surgery.

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### Introduction

The rapid increase in antibiotic resistance has become a critical global problem in recent years. Although many contributory factors have been identified in the development of antibiotic resistance, the inappropriate use of antibiotics is certainly one of the primary causes [1]. Hence, in order to mitigate antibiotic resistance, one of the most important tasks of physicians, such as ourselves, must be to show the necessary duty of care for the correct use of antibiotics [2]. Unfortunately, the inappropriate use of antibiotics continues to be documented, both in our own country and abroad [3-5]. According to a study published in 2014, Turkey was reported to have the highest rate of antibiotic usage among 42 European Union (EU) and

non-EU countries. The study showed that the Turkish level of antibiotic use was at least 3.5 times higher than that of the country with the lowest usage [3].

While irrational drug use (IDU) in the field of internal medicine generally arises from a failure to follow guidelines for treating infections; in the surgical field, it frequently occurs during the administration of surgical antibiotic prophylaxis (SP) [6]. The Cochrane review [7] describes antibiotic stewardship programs (ASP) for the reduction of IDU in both surgical and internal branches. These ASPs generally have a positive effect on rational drug use (RDU) and are organised into two broad groups of techniques - ‘restrictive’ and ‘enablement’. However, in routine practice, ASPs generally consist of combinations of subcomponents of

these two main groups [7]. In addition, ASPs do not prescribe a standard method for any one country, region or specific branch of medicine (e.g. general surgery, orthopedics, internal medicine, etc.) [7] and the chosen ASP does not always produce the expected effect [8]. For these reasons, national policies on rational drug use (RDU) need to be created. At the time of publication of Versporten *et al.* [3], the Turkish RDU national action plan for 2014-2017 had only just been established. However, now this action plan has been in use for several years and its effects, positive or negative, are visible. An article describing national drug policy development processes suggests that the effects of these processes should be evaluated every four years [9]. This assessment would encourage progress in achieving the agreed goals and objectives and would create a standard in terms of process, allowing comparisons between countries and regions. The same article points out that the monitoring process is often disrupted by insufficient human resources and budget, the difficulty of interpreting excessive data and a lack of appreciation of its value.

During our research, we were unable to locate any data analysis published after the 2014-2017 RDU national action plan that included general surgeons across Turkey. Although there are studies examining SP in our country, they include all surgical sub-specialities (urology, gynecology, orthopedics, cardiovascular surgery, etc.) and also omit to mention the antibiotics prescribed during patient discharge [10-12]. Moreover, since these studies were compiled pre-2017, they do not evaluate the effects of the recently implemented RDU policy. Therefore, in contrast to these studies, our research was planned to evaluate the use of SP by general surgeons, alone. The primary objective of this study is to determine the adherence of general surgeons to SP guidelines and to reveal the causes for any non-compliance. Secondly, our study aims to consider any implications for the implementation of a RDU national action plan and to collect comparable data for future studies. According to our hypothesis, since the use of SP in general surgery is not clearly defined in the 2014-2017 national RDU action plan, inappropriate SP usage rates are likely to be high.

## Methodology

### *A cross-sectional study*

Local ethics committee approval was received for this study (21/13-2017). The questionnaire used for our survey was prepared together with infection control committee experts and general surgeons and firstly given to general surgeons in a tertiary education and

research hospital [4]. Between May 2018 and April 2019, the questionnaire was distributed using a variety of methods: via e-mail, by hand, and posted on the web pages of various regional and national surgical associations. Participation was voluntary. In order to increase participation, questionnaires were sent to the participants several times or a reminder message was sent via the associations' web pages. Participants were informed that the questionnaire investigated actual SP habits in their daily practice. No records were made of any information which could facilitate the identification of the participants, such as name, age or name of institution, to ensure anonymity.

In the first part of the questionnaire, information on the seniority of the participants (resident/consultant); their years in the profession and the type of institution they worked at (university hospital, training and research hospital, state hospital or private hospital) was requested. The subsequent questions referred to the participants' approach to the use of SP on clean and clean-contaminated elective cases, during their routine practice. In order to avoid any confusion over the two wound categories, each category was defined as clean (thyroidectomy, breast and hernia operations without implants) or clean-contaminated (elective cholecystectomies, stomach and colorectal surgeries) in both the questions and answers. Our questions, for both clean and clean-contaminated groups, focused on the correct preoperative indications for SP, correct timing of the first antibiotic dosage and whether further intraoperative antibiotic doses were usually given. Additionally, the participants were asked whether they prescribed antibiotics postoperatively (exceeding 24 hours) and/or at discharge from hospital. In order to understand the motivation for inappropriate SP usage, participants were presented with closed and open-ended questions with the option to select one or more answers. The Turkish version of the questionnaire is available on request from the authors.

### *Evaluation of inappropriate SP usage*

The answers to the questions were evaluated according to ASHP guidelines [13]. According to these standards, the following were considered to be 'inappropriate' SP: patients who should have received preoperative SP but did not; patients who should not have received preoperative SP but did; patients whose first preoperative SP application was not performed in the 60 minutes previous to incision; patients whose SP should have been repeated due to prolonged operation time or intensive intraoperative bleeding but was not;

SP usage exceeding 24 hours and the prescribing of antibiotics on discharge.

### Exclusion criteria

Questions about SP practice in emergency cases or in patients with contaminated or dirty wounds were not included in the questionnaire. Incomplete questionnaires were not evaluated.

### Statistical methods

Descriptive statistics are given as frequency (n) and percentage (%) for categorical data. Two proportion z test or Pearson chi-square test were used to evaluate categorical data, depending on the assumptions. Type I error or significance level was found to be 0.05. Analyses were performed using IBM SPSS V22.

## Results

332 general surgeons responded to the study. Of these, 15 could not be included in the study, as one participant was an ICU subspecialist, 5 participants were missing demographic data, and 9 participants did not complete the questionnaire. A total of 317 questionnaires with complete data were evaluated. While 184 (58%) of the participants were residents (trainee surgeons), 133 (42%) were qualified consultants (this group also includes the academic positions of head resident, assistant professor, associate professor and professor). 63.4% of the participants had between 1-5 years' experience in the profession. 57.6% of the participants reported working in training and

**Table 1.** Demographic characteristics of the participants.

Characteristics	Percentage
Consultant	42%
Resident	58%
<b>Years of experience</b>	
< 5 years	63.4%
5-10 years	9.8%
11-20 years	14.8%
> 20	12%
<b>Institution</b>	
Education and research hospital	47.6%
Public hospital	16.1%
Private hospital	7.3%
University hospital	29%

research hospitals, 29% at universities, 16.1% in state hospitals and 7.3% in the private sector. Table 1 presents the demographic characteristics of the participants.

In this investigation of the application of SP in both clean and clean-contaminated patients, the overall percentage of correct answers, according to ASHP guidelines, was 26.8%. While 26% of the residents answered all the questions correctly, the rate for consultants was 28% ( $p = 0.732$ ).

The rate of correct answers to questions about treating clean-wounds was 49.2%; higher than the rate for correct clean-contaminated wound questions at 30.9% ( $p < 0.001$ ). Meanwhile, the rate of correct answers to questions about clean-wound management given by residents and consultants was 50% and 47%, respectively ( $p = 0.577$ ); while the correct answer rate

**Table 2.** Reasons for inappropriate SP.

Causes of the use of inappropriate SP preoperatively	Clean wounds	Clean-contaminated wounds
Prophylaxis to all	24.6%	41.6%
Prophylaxis to none	6.3%	2.2%
Due to pressure from patients and their relatives	5.4%	3%
<b>Causes of continuation of SP postoperatively on the days of hospital stay</b>		
Presence of foreign body (mesh, silicone implant, drain, etc.)	12%	25.6%
Discontinuation of SP worries me about infective complications	0.6%	21.8%
If the patient's fever rises or the number of white cells increases	14.5%	18%
Due to pressure from patients and their relatives	3.2%	7.6%
If I doubt about cleanliness of the environment (operating room / service)	5.4%	5.7%
Because my senior wants	0.6%	2.8%
<b>Causes of SP at discharge prescription</b>		
Discontinuation of SP worries me about infective complications	6.9%	24.3%
Presence of foreign body (mesh, silicone implant, drain, etc.)	11.0%	15.5%
If the patient's fever rises or the number of white cells increases	9.7%	11.4%
If I doubt about the cleanliness of the environment (operating room / service)	7.9%	8.4%
Due to pressure from patients and their relatives	3.5%	6.3%
Because my senior wants	2.5%	2.8%

about clean-contaminated wounds was 29.9% for residents and 32% for consultants ( $p = 0.644$ ). The main motivations for inappropriate SP in both clean and clean-contaminated wound groups were given as the presence of foreign bodies in patients, such as drains and catheters; anxiety of physicians about the possible development of infectious complications; and fever or increased white blood cells count (Table 2 gives detailed reasons for inappropriate SP).

The compliance rate for preoperative SP was 69.7% for clean wound cases and 54.6% for clean-contaminated wound cases. 96.5% of participants administered the first dose of SP at the correct time, while the correct administration of additional SP was specified by 79.5% of the participants. The proportion of responses indicating ‘I continue SP on the days they [patients] stay on the post-operative ward’ was 33% and 47.6% in clean wound and clean-contaminated wound cases, respectively. The percentage of surgeons who would continue antibiotics after discharge was 22.7% for clean wound cases but 38.5% for clean-contaminated cases (Table 3 gives details of SP stages).

Responses to the open-ended questions in our survey were not included in our assessment since they were only answered by 7 (2.2%) participants. Although these participants mostly marked the “other” option, they offered no explanatory remarks.

## Discussion

We consider this study to be of importance because it provides the general surgeons’ perspective of administering SP to elective patients with clean and clean-contaminated wounds in our country. To our knowledge, in Turkey, this is the first study to question only general surgeons with a nationwide survey and to evaluate SP prescriptions at discharge. According to our results, it seems that general surgeons in our country demonstrate only partial compliance with guidelines for administering SP and they prescribe a significant amount of antibiotics at discharge. Our data provides important indications that any RDU national action plan should include clear guidelines regarding SP for surgical patients with clean or clean-contaminated

wounds, including recommendations for SP prescription at discharge.

According to our results, only 26.8% of participating surgeons showed compliance with all stages of SP. The recognition of such a low compliance rate, despite the availability of SP guidelines, regular updates by infection control committees and the control of antibiotics by infection control committees in most hospitals, is probably the most significant finding of our study. In literature evaluating how various surgical groups utilize SP, quite different rates of total compliance have been reported. For example, while total compliance to SP was less than 1% in Iran [14] and Korea [15], it was measured as 8-39.3% [4, 10, 11, 16] in our country and 83.3% in South Africa, after introducing ASP [17]. A study by Hulscher *et al.*, shows this variation in rates of antibiotic usage in hospitals to be influenced by many factors, such as cultural and contextual aspects, sociocultural and socioeconomic factors, organizational policies, attitudes and knowledge of the physician as well as the personality of both patients and doctors [2]. It is also recognised that surgeons in different branches or physicians from different regions have different habits regarding SP usage [18]. For this reason, it would be more fitting to compare our data with that of other studies from our own country, thereby evaluating national SP usage and effects of the RDU national action plan. Unfortunately, despite consulting literature from within the country and abroad, we have failed to uncover any nationwide study which involves only general surgeons, and examines both SP administration and discharge prescriptions, jointly. However, national and regional studies have been conducted evaluating different surgical branches collectively (general surgery, orthopedics, gynecology, neurosurgery, etc.) in our country. In two different studies where single centers were evaluated according to a Turkish national survey conducted in 2003, the rate of correct response to all SP stages given by surgeons was 26% [10] and 19.7% [16]. Also, in a multicentre survey conducted in 2013, the total compliance rate was found to be 34% [12]. In that study, 33.3% of 109 general surgeons who participated

**Table 3.** Examination of SP stages.

	Clean wounds		Clean-contaminated wounds	
	TRUE	FALSE	TRUE	FALSE
Indications for the use of preoperative SP	69.7%	30.3%	54.6%	45.4%
Optimal timing for SP administration	96.5%	3.5%	96.5%	3.5%
Indications of SP re-dose during surgery	79.5%	20.5%	79.5%	20.5%
Discontinuation of SP postoperatively on the days of hospital stay	77.0%	23%	52.4%	47.6%
SP given at hospital discharge	77.3%	22.7%	61.5%	38.5%

in the survey achieved total compliance with SP guidelines. This rate is higher than the total compliance rate in our study; however, in their study, discharge prescriptions were not examined, and details of SP were not reported. Therefore, only total compliance rates could be compared. Hence, the above studies and our own study emphasize that the total compliance to SP rate is low in our country. This in turn suggests that our surgeons prefer to act individually, independent of SP guidelines or infection control committees, and reinforces our thesis that SP should be detailed in the national RDU action plan.

In view of the fact that general surgeons participating in our study report that they continued SP in approximately one third of their discharge prescriptions, it is our opinion that all phases of SP, including discharge prescriptions, should be considered when calculating total compliance rates. Few studies have addressed the prolongation of SP after discharge. In a study by Bozkurt *et al.*, 17.4% of pre-ASP patients were prescribed antibiotics at discharge while this rate decreased to 5.5% after ASP was introduced [19]. Two other studies from our country evaluated the SP practice of only general surgeons and included discharge prescriptions, similar to ours. Among these, Urgancı *et al.* [20] claimed that 88.5% of discharge prescriptions contained antibiotics, whereas Karaali *et al.* reported that surgeons reduced their prescription rates from 80.6% to 9.4% after the introduction of a modified ASP method [21]. All these data indicate that antibiotics are used at differing rates in prescriptions of patients being discharged in Turkey, and support our opinion that this data should be included when calculating total compliance to SP. However, in the above studies, the authors provide limited information and present very different rates from each other, since they only examine the discharge prescriptions in their own hospitals. In contrast, by inviting the participation of both residents and consultants throughout the country, our study provides a significant data collection. Furthermore, the fact that there was no statistical difference in our study between the total compliance rates of residents and consultants supports the thesis that trainee surgeons learn from their seniors rather than from the guidelines [22]. This data is key in understanding why trainees and consultants should be given equal priority in any ASP studies in our country. It is, clearly, easier to educate residents who are at the start of their training than to retrain experienced surgeons whose behavior patterns are well-established; however, the failure of our consultants to participate sufficiently in an ASP, will inevitably decrease its success [8].

On examining reasons for non-compliance in preoperative SP, it was found that most participants had a tendency to routinely administer preoperative SP to all their patients. Furthermore, the ratio of those who checked 'I prescribe SP for all patients' was higher for the clean-contaminated wound class than in clean cases. The guidelines state that SP may be used in clean and clean-contaminated cases if there is a high risk of infection [13]. However, when clean-contaminated operations in general surgery are examined, the risk of infection and, consequently, the need for SP, is seen in almost all such operations, except laparoscopic low risk cholecystectomies. Moreover, the guidelines accept that SP may be used in all cases of laparoscopic cholecystectomy since high-risk circumstances (such as diabetes mellitus, extended length of procedure, intraoperative rupture of the gallbladder, bile spillage) cannot be predicted. This is likely to be the motivation for a higher rate of SP administration 'to all patients' in the clean-contaminated wounds category.

In our study, 96.5% of the participants reported using the correct timing for administering SP (within 60 min before and at induction of anesthesia). In a survey conducted by Koçak *et al.* in 2013, 75.2% [12] of surgeons described the correct time for giving the first SP dose, while in a study by Karaali *et al.*, where only general surgeons were examined, 81.9% of surgeons timed the first dose correctly. Our study showed that general surgeons in our country correctly time the first SP dose to a significant degree. Failure to provide SP at the right time results in low concentrations of antibiotics in tissue and serum, thereby increasing infection rates [23]. However, in prolonged surgeries or surgeries with severe bleeding, additional doses should be given [13]. While 79.5% of the participants in our study stated that they applied a perioperative additional dose of antibiotics during prolonged surgeries and/or surgeries with severe bleeding, in a survey by Koçak *et al.* [12], only 63.9% of surgeons reported using additional doses of antibiotics during long operations.

According to the results of our study, 35.5% of the general surgeons who participated in the survey used SP for more than 24 hours, while 30.6% continued SP with a discharge prescription. Meanwhile, 80% of the participants in a survey by Hosoglu *et al.* [10], and 56% of the surgeons in a multicentre study by Koçak *et al.* [12] reportedly used SP for over 24 hours. In a study performed in a tertiary hospital, surgeons were evaluated collectively and the mean antibiotic usage rate at discharge was found to be 47.3% [24]. While in the studies of Urgancı *et al.* [20] and Karaali *et al.* [4] in which only general surgeons were examined, SP > 24

hours usage rates were 44% and 60.1%, respectively, these rates were found to rise to 88.5% and 80.6% in the discharge prescriptions; thus, their non-compliance rates were higher than in our study. Factors such as the physicians' lack of awareness, pressure from pharmaceutical companies, the absence of antibiotic usage policies or an absence of national antibiotic guidelines have all been listed as common reasons for the irrational use of antibiotics [25]. However, Karaali *et al.* [4] reported the most significant grounds for using SP > 24 hours and prescribing antibiotics at discharge to be the presence of drains or catheters, an increase in fever or white blood cell count, an extra layer of security, and strengthening the patient's defence mechanism in case of infection. In addition, in a study by Koçak *et al.* [12], 63.7% of surgeons were reported to maintain SP until the drain was removed, in operations employing surgical drains. In our study, the most common reasons given for continuing SP > 24 hours and including antibiotics on discharge prescriptions were the presence of foreign bodies such as drains, catheters or implants; an increased fever or white blood cell count in the patient; the doctor's anxiety about possible infectious complications due to a lack of antibiotics in the postoperative period. Considering that prior to discharge most patients have already had surgical appliances such as catheters and drains withdrawn and would have clinical and laboratory values within normal limits, we can infer that the main reason for antibiotics to be prescribed at discharge is the concern about the possible development of an infectious complication after the patient has left the hospital. Indeed, in various publications, even in patients with a National Nosocomial Infections Surveillance risk index of 0, wound infections are reported to be 2.7%-4.2% in hospital and 7.1%-9.8% after discharge [26, 27]. Therefore, surgeons may be extending SP to discharge prescriptions because they are concerned about an infectious complication that might develop and that might fail to be detected in time. Nonetheless, one important point to bear in mind is that since most wound infections are acquired during surgery, starting SP at the appropriate time is more effective than prolonging SP during the postoperative period [13, 28]. In addition, if patients should develop a fever or there is an increase in their white blood cell count, a rigorous investigation for different infection foci in order to combat the source of infection is a far more efficient response than changing or prolonging the antibiotic [29].

Limitation of this study; more reliable results could have been obtained with the participation of a larger

number of general surgeons. In addition, the answers given by the participants to the questions may not accurately reflect their actual practice. Moreover, the hospitals or regions where the participants work are not documented and there is limited participation from the private sector. Nevertheless, although the results of our study are not sufficient to give a definitive judgment on a national basis, we believe our results provide important indications about the use of SP by general surgeons in our country.

## Conclusions

Our nationwide study evaluated the real-life practice of using SP for clean and clean – contaminated wounds and extending SP to discharge prescriptions, but, unlike previous studies, limited participants to general surgeons only. According to the data obtained from our study inappropriate SP administration is widespread and the extension of SP to discharge prescriptions is an important aspect of non-compliance in our country. Reasons for inappropriate SP are the presence of foreign bodies, the concerns of physicians about infectious complications, high fever and increase in the number of white blood cells of the patients.

Consequently, this research could be used as a starting point for setting targets for general surgeons in new RDU national action plans. The data collected should alert our National health-policy makers to the need for a section on the administration of SP to surgical patients in any future RDU action plan.

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## Authors' Contribution

All authors contributed equally to this manuscript.

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### Corresponding author

Cem Karaali, MD  
 University of Health Sciences Izmir Tepecik Training and Research Hospital, Department of General Surgery Guney mh. 1140/1 Sk No: 1,  
 35170 Yenisehir, Izmir, Turkey.  
 Telephone: +232 4696969  
 E-mail: cemkaraali@gmail.com

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