

The compliance of surgical prophylactic antibiotics with standard protocols in Imam Reza teaching hospital of Birjand, Iran

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ABSTRACT

Background and Objectives: Taking unnecessary or inappropriate prophylactic antibiotics can cause infections with resistant organisms. The present study aimed to investigate administration prophylactic antibiotics in surgery ward and its compliance with standard protocol in Imam Reza teaching hospital of Birjand, Iran.

Materials and Methods: This descriptive-analytical study was performed to evaluate the pattern of prophylactic antibiotics on patients who underwent surgical operations from October to December 2019. A checklist including demographic information, type of prophylactic antibiotics, dose and duration of using drug, type of surgery, and compliance with standard protocol was used. The validity and reliability of the checklist were evaluated and confirmed prior to the study. All eligible patients were enrolled and the information of the prescribed drugs in the surgical wards was compared with the Schwartz's principles of surgery as standard protocol.

Results: Out of a total of 300 patients, 187 (62.3%) were male. Among the patients, 155 (51.7%) cases underwent general surgery, 119 (39.6%) cases orthopedic surgery, and 26 (8.7%) cases neurosurgery. The most popular prescribed antibiotics were cefazolin (170 cases) and ceftriaxone + metronidazole (67 cases). Furthermore, the maximum antibiotic administrations were two days (127 cases) and one day (93 cases). More importantly, 67.7% and 92.3% of the patients were in compliance with the standard protocol in terms of the type and time of administration, respectively.

Conclusion: Our results showed that duration and route of administrating antibiotics were consistent with the standard protocol, but the type of drugs and indication did not match.

Keywords: Antibiotic prophylaxis; Guideline; Surgery; Compliance; Iran

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INTRODUCTION

Nosocomial infection is referred to an infection which occurs 48 hours after hospitalization and even up to one month after discharge (1). One of the most common reported nosocomial infections is surgical-associated infection. Surgical site infections (SSI) with a 38% outbreak is the most commonly reported nosocomial infection that usually occurs up to one month after surgery; however, in the presence of any external object during the surgery, infection can be expected up to one year later (2). Although the prophylaxis of antibiotics has reduced the prevalence of surgical infections, its incorrect and irrational administration causes important complications such as drug reactions, emergence of the resistant strains, drug resistance, and increased treatment costs. To prevent and reduce antibiotic resistance, the antibiotics should be prescribed correctly and scientifically, and factors such as the type of microorganism, the dose of drug, the type and duration of use, and prescribing antibiotics should be appropriate to the infection (3).

There are various guidelines available to help adhere to the principles of preventive antibiotic prescription in surgery (4-7). In this context, several studies have been conducted to assess the pre-operative administration of antibiotics (5, 8-10). Karaali et al. (2019) evaluated antibiotic prophylaxis and discharge prescriptions in the general surgery wards. Based on their results, the total accuracy rate of surgical antibiotic prophylaxis was 7.1%. Also, the antibiotic prophylaxis use with the appropriate indication and timing of the first dose was compliance with guidelines: 55.6% and 81.9%, respectively (11). In another study by Saxena et al. (2015), the use of prophylactic antibiotics was evaluated in patients admitted to surgical wards and compared with scientific guidelines. The results demonstrated that the active antimicrobial dose was prescribed in 55.7% of cases one hour before the operation and the instructions in 92.6% of cases were in compliance with the guidelines (12). Considering the importance of prescribing prophylactic antibiotics in preventing perioperative infections, there is an urgent need for standardized guidelines on the correct antibiotic type, dose, timing, route of administration, and duration. Therefore, the present study aimed to investigate administering prophylactic antibiotics in the surgery ward and its compliance with standard guideline in Imam Reza

teaching hospital of Birjand, Iran.

MATERIALS AND METHODS

This descriptive-analytical study was carried out based on the patient's chart to evaluate the pattern of prophylactic antibiotics on patients who underwent general surgery, orthopedic surgery, and neurosurgical operations at the Imam Reza teaching hospital in Birjand from October to December 2019. Exclusion criteria were emergence of fever after antibiotic administration, positive blood culture, any therapeutic evidence for antibiotic need, and taking antibiotics before surgery for any reason other than prophylaxis.

Initially, a checklist including demographic and clinical data, type of antibiotic prophylaxis, dosage, duration of administration, type of surgery, and consistency with prescribing instructions (antibiotic type and dose, timing, and route of administration) was prepared. The validity and reliability of the checklist were evaluated and confirmed prior to the study. To follow, after the approval of the study by the Research Council of Birjand University of Medical Sciences and obtaining an ethical code (IR.BUMS.REC.1396.34), the checklists were completed using the profile of the patients who underwent surgery and met the inclusion criteria. Finally, the data related to the prescribed drugs in the surgical wards were compared with Schwartz's Principles of Surgery (13).

The collected data entered in SPSS software version 18 (SPSS Inc., Chicago, USA) and analyzed using chi-square test; $\alpha=0.05$ was considered as the significance level. Also, central indices such as mean and standard deviation were used to analyze quantitative data, and Chi-square test was used for assessing qualitative data at the significant level $\alpha=0.05$.

RESULTS

In the current study, 386 patients who required prophylactic antibiotics after surgery were evaluated from October to December 2019. Of these, 76 patients were excluded due to a history of pre-hospital antibiotic use (22 cases), positive blood culture (14 cases), underlying disease and the need for specific antibiotics (10 cases), and obvious clinical infections such as pneumonia (30 cases). In a second screening, 10 other patients were excluded due to incomplete clinical

cal information. Finally, 300 patients (males: 187 vs. females: 113) met the inclusion criteria and were enrolled in the study.

The majority (192 [64%]) of patients were under 40 years old and some of them suffered from different diseases such as diabetes (18 [6%]), chronic obstructive pulmonary disease (COPD) (11 [3.7%]), heart disease (11 [3.7%]) (Table 1). Also, 28 (9.3%) patients had a

Table 1. Demographic and clinical characteristics of participants

Characteristics		N (%)
Gender	Male	187 (62.3)
	Female	113 (37.7)
Age group	< 20 y	91 (30.3)
	20-40 y	101 (33.7)
	40-60 y	67 (22.3)
	> 60 y	41 (13.7)
Ward	Surgery	155 (51.7)
	Neurosurgery	26 (8.7)
	Orthopedic	119 (39.6)
Risk factor	Diabetes	18 (6)
	COPD	11 (3.7)
	Heart diseases	11 (3.7)
	Antibiotic usage history	28 (9.3)
Surgery type (Surgery ward) N=155	Appendectomy	59 (38.1)
	Cholecystectomy	13 (11.6)
Surgery type (Orthopedic ward) N=119	Plastic surgery	24 (15.5)
	Others	54 (34.8)
	Clean orthopedic	30 (25)
	Dirty orthopedic	89 (75)

history of previous antibiotic use. Among the evaluated patients, 155 (51.7%) cases were hospitalized in the general surgery ward, 119 (39.6%) in orthopedic ward, and 26 (8.7%) in neurosurgery ward (Fig. 1).

The most commonly prescribed antibiotics were cefazolin (n=170), ceftriaxone + metronidazole (n=62), and cefazolin + gentamicin (n=25) (Table 2). Among the studied cases, the highest durations of administering antibiotics were two days (n=127) followed by one day (n=93) and three days (n=47). Regarding the prescription route, all patients had received antibiotics intravenously. In terms of antibiotic type and the time/route of administration, 176 (67.7%) and 276 (92.3%) of prescribed cases were matched with Schwartz's Principles of Surgery (Fig. 2). The results revealed that 24 patients with orthopedic surgery did not need

antibiotics according to the guidelines, which was not prescribed in only one case. Consequently, the rate of compliance with the guideline was only 4.2%.

In terms of surgery type, the lowest and highest compliance rates were related to appendectomy and plastic surgery, respectively. The highest durations of administering antibiotics in the surgery ward were two days (73 cases) and one day (49 cases), of which 71 cases were not matched with the guidelines (Table 3). In the neurosurgery ward, the highest durations of prescribing antibiotics were three days (11 cases) and five days (9 cases), of which seven cases were inconsistent with the guidelines. In the present study, compliance with the guidelines was assessed from four aspects including the type of antibiotics, duration of administration, method of administration, and whether or not there is a need for administering antibiotics. The highest durations of administering antibiotics in the orthopedic ward were two days (55 cases) and one day (41 cases), of which 43 cases were not matched with Schwartz's Principles of Surgery. While 176 (67.7%) cases were consistent with guidelines in terms of the type of antibiotics, this finding for the time/route of administration was 276 (92.3%) cases (Fig. 2). Out of 24 patients who did not need antibiotics, only one case did not receive it and most of the non-compliant cases were from clean orthopedic surgeries. While duration and route of administering antibiotics were consistent with the standard guidelines, antibiotic type and indication were not according to the standard guidelines.

DISCUSSION

This study was performed on 300 patients admitted to the surgical wards of the Imam Reza teaching hospital of Birjand, Iran. Among the patients, 155 cases were from the general surgery ward, 119 cases from the orthopedic ward, and 26 cases from the neurosurgery ward. In terms of type of surgery, the highest number of patients was related to dirty orthopedics and appendectomy, and the lowest number of patients was related to cholecystectomy and plastic surgery. The most commonly prescribed antibiotics were cefazolin, ceftriaxone + metronidazole, and cefazolin + gentamicin. Regarding the prescription route, all patients except for one case received antibiotics intravenously. The highest durations were two days followed by one day and three days. In a study, Khan et al. (2020) evaluated the proportion of

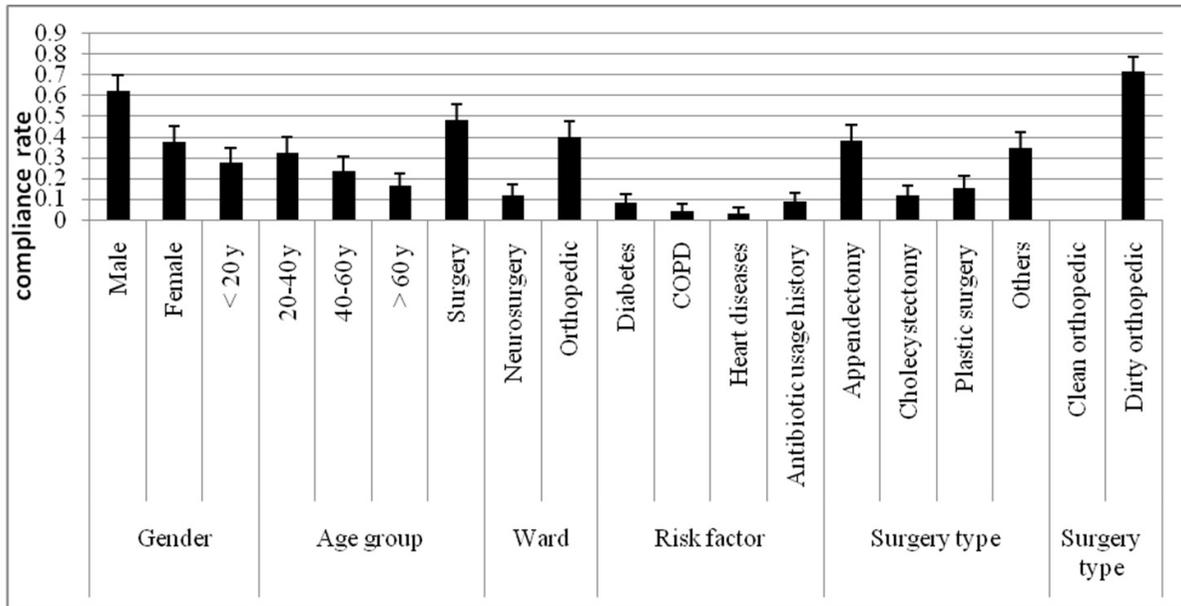


Fig. 1. Comparison of rate of compliance of antibiotic use according to participants' characteristics

Table 2. Type of used antibiotics by ward in the studied patients

Ward	Surgery	Orthopedic	Neurosurgery	Overall
Antibiotic	N (%)	N (%)	N (%)	N (%)
Cefazoline	71 (46.1)	81 (68.1)	18 (69.2)	170 (56.9)
Ceftazidime	4 (2.6)	0 (0)	3 (11.5)	7 (7.23)
Cefazoline + Gentamycin	0 (0)	23 (19.3)	2 (7.7)	25 (4.8)
Metronidazole + Vancomycin	1 (0.6)	5 (4.2)	0 (0)	6 (2)
Ceftriaxone + Metronidazole	62 (40.3)	0 (0)	0 (0)	62 (20.7)
Ceftriaxone + Clindamycin	9 (5.8)	4 (3.4)	0 (0)	13 (4.3)
Others	7 (4.5)	6 (5)	3 (11.5)	16 (5.4)

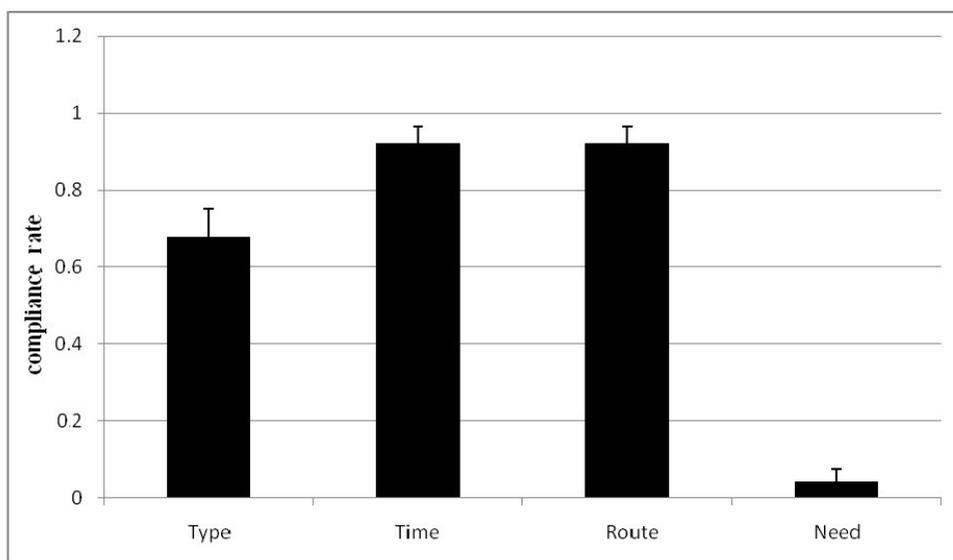


Fig. 2. Antibiotic compliance in terms of need for prescription, type of antibiotic and duration of antibiotic use

Table 3. Comparison of rate of compliance of antibiotic use according to participants' characteristics

Characteristics		N (%)	P value
Gender	Male	100 (62.5)	0.94
	Female	60 (37.5)	
Age group	< 20 y	44 (27.5)	0.39
	20-40 y	52 (32.5)	
	40-60 y	38 (23.75)	
	> 60 y	26 (16.25)	
Ward	Surgery	77 (48.12)	0.08
	Neurosurgery	19 (11.88)	
	Orthopedic	64 (40)	
Risk factor	Diabetes	13 (8.12)	0.14
	COPD	7 (4.36)	0.35
	Heart diseases	5 (3.12)	0.4
	Antibiotic usage history	14 (8.75)	0.43
Surgery type (Surgery ward) N=67	Appendectomy	3 (38.1)	< 0.001
	Cholecystectomy	13 (11.6)	
	Plastic surgery	22 (15.5)	
	Others	39 (34.8)	
Surgery type (Orthopedic ward) N=64	Clean orthopedic	0 (0)	< 0.001
	Dirty orthopedic	64 (71.9)	

the pre-operative antibiotic prophylaxis (PAP) practices in common elective surgical procedure at two tertiary care teaching hospitals of Islamabad, Pakistan. Regarding the route and dose of drugs, 100% of cases were consistent with the guidelines and the most commonly used antibiotic was ceftriaxone (10). In another study, Mousavi et al. (2017) evaluated the use of antibiotics in the surgical wards according to the recommendation of ASHP guideline. It has been reported that out of 100 patients with antibiotic prophylaxis indication, about 22% of procedures had full compliance with all guideline recommendations. In addition, the most common types of non-compliance were the duration of prophylaxis (14%) and appropriate agent choice (35%). Timing of the initial dose was suitable in most of the procedures (42%) (14). However, in the study by Saxena et al. (2015) conducted on 34133 hospitalized patients, 55.7% of cases were prescribed prophylactic antibiotics, of which 92.6% were in accordance with the guidelines, and the most commonly used antibiotics were cefazolin followed by ceftriaxone (12). In a study, Jimah et al. assessed the knowledge and attitudes of 400 people over the age of 18 about antibiotics and antibiotic resistance in Ghana. In their study, 70% of cases received at least one type of antibiotics within a year. The most common antibiotics were tin-amoxicillin, amoxicillin,

ampicillin, ciprofloxacin, and metronidazole. Also, the rate of using antibiotics was higher in women than men. In addition, the results showed that 63% of subjects were unaware of antibiotic resistance (15).

In comparison to other studies in Iran and abroad, the compliance with standard guideline observed in our study was lower; this may be due to the lack of a common and standard protocol in our surgical department compared with other studies. In this regard, applying a standard guideline will result in a higher percentage of patients receiving appropriate antibiotics. In terms of the type of antibiotics, the present study was consistent with many studies; however, other studies mostly used mono-therapy, which is a positive point (16).

In our study, combination therapy was predominant, which could be a warning sign. It is strongly recommended to shift from combination therapy to mono-therapy so as to reduce drug resistance, side effects, and related costs (11). In terms of the surgery type, appendectomy had the least compliance in our study, whereas plastic and orthopedic surgeries had the highest compliance with the guideline. In several other studies, the lowest and highest prophylactic antibiotic compliance were found in appendectomy and orthopedic surgery, respectively (17-19).

Since appendectomy is usually considered emer-

gency and in some cases there is a peritoneal risk of peritonitis (20), the surgeons prescribed higher level of antibiotics in our study, leading to lower compliance with the standards. In contrary, since most plastic surgery cases are elective and non-emergency, appropriate antibiotics may be started with greater prophylaxis opportunity. Also, since there is a peritoneal risk in some cases, the surgeons may prescribe higher levels of antibiotics, which can lead to lower compliance with the standards.

In our study, in terms of the time and route of administration, 92.3% of cases were in accordance with the standards, and the highest durations of administering antibiotics were two days (73 cases) followed by one day (49 cases). However, 71 cases did not comply with the standard guideline. In the neurosurgery ward, the highest durations were three days (11 cases) and five days (9 cases), of which seven cases were not in compliance with the guideline. In orthopedics ward, patients received antibiotics for two days (55 cases), one day (41 cases), and three days (18 cases), of which 43 cases did not match with the standard guideline. The duration of administering antibiotics in surgery and orthopedic wards was significantly different from the existing standards. In the study by Mousavi et al. (2017), 100 cases received antibiotics, of which 42% were consistent with the guidelines in terms of intervals and correct time for antibiotic prophylaxis (14). This figure was 27.2% in the study by Gouvêa (17).

In two studies carried out by Lewis et al. (2014) and Blomberg (2002), the consistency with standards for prophylactic antibiotic intervals and duration was 55% and 75%, respectively (21, 22). Our study is in line with several national surveys, but differs from international studies in terms of the time of administration. In this context, it is significantly different from the standard administration time, which means that administering antibiotics in surgery wards needs to be revised. In addition, if the standard and common guidelines are applied, all the related components including the dose and timing must be observed. Perhaps because of the importance of surgery itself and that physicians, nursing staff, and even patients themselves emphasize the importance of surgery, they pay low attention to other issues such as the method of administration and the type of antibiotics. The urgency of some surgeries, such as appendectomy and cholecystectomy, causes the surgeon to pay less attention to standard guidelines,

resulting in inappropriate prescription of antibiotics (23, 24).

CONCLUSION

In the current study, the duration and method of prescribing prophylactic antibiotics were generally complied with the standard guideline, while there was a discrepancy in the type of prescribed drugs and the need for administering antibiotics. In particular, we showed that due to the large number of antibiotics, the prescriptions of these drugs were based on physicians' experience or textbooks, which may differ from the guidelines. Therefore, it is suggested that regular monitoring be performed for using prophylactic antibiotics in surgical wards based on the standard guidelines and the reasons for inappropriate use of antibiotics in each hospital be investigated to avoid prescribing such drugs.

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