Antibiotic Prescription Patterns in an Academic Emergency Department in Iran

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Abstract

Introduction: It is estimated that between 30 to 60 percent of antibiotics are prescribed inappropriately. Antibiotic prescription for hospitalized patients, especially in the emergency department, and their frequent changes by various services is concerning. This study was performed to determine the status and pattern of antibiotic prescription in the emergency department of Imam Reza hospital.

Methods: Five-hundred and forty patients participated in this cross-sectional study, which was conducted at the emergency department of Imam Reza hospital, Mashhad, between August 2014 and July 2015. Demographic information, clinical symptoms during admission, prescribed antibiotic regimens (including type and dosage) and changes in the treatment regimen, were recorded and statistically analyzed.

Results: Patients who required more long-term hospitalization were provided a consultation. The most frequent consultation requests were sent to internal medicine (433, 80.2%), followed by infectious diseases (66, 12.2%) and surgery (38, 7%) wards. Three-hundred and seventy nine patients received at least one antibiotic by various services; among them cephalosporins (85.2%) and macrolides (23.8%) were the most common. One-hundred and eleven patients who received antibiotics (29.2%) had at least one change in the prescribed antibiotic, among them changing the consumed antibiotics occurred once for 79, twice for 24, three times for 5, and four times for 3 patients.

Conclusions: The study indicates differences in antibiotic prescription patterns among physicians in emergency medicine department compared with those of other services. These differences and inconsistencies can be significantly reduced by periodic educational programs and review of the antibiotics prescribed for each patient.

Key words: Antibiotic prescription, Emergency department, Antibiotic regimens

Introduction

Appropriate use of medications is the cornerstone of pharmaceutical policies. The World Health Organization (WHO) considers the consumption of medications with effective treatment impact as a fundamental way to achieve this purpose (1, 2). However, many different reports suggest that approximately 30-60% of prescribed drugs have been inappropriate. Physicians, distributors and the patients, through self-treatment, have been responsible for such drug abuse (3, 4).

In 1990, 12% of the worldwide total sales of drugs were antibiotics (5). The contribution of developing countries to this sale has risen from 19% to 34% in a 10 years period, which reflects the increase in the cost of antibiotics especially in developing countries, despite efforts to limit the excessive use of antibiotics (5). In the United States, 450 million dollars is spent on antibiotics for the treatment of respiratory tract infections, bronchitis, and sinusitis, annually. Since most of these infections are viral, even if half of these prescriptions are incorrect, as studies have shown, every year about 225 million dollars are being wasted solely in the treatment of such infections (6). It is estimated that between 25 to 35 % of drug budgets are allocated to antibiotics (7). This ratio has been estimated to be 20 % in Iran (8).

Furthermore, inappropriate consumption of antibiotics has undesirable effects such as microbial resistance (9, 10). On the other hand, controlling the consumption of antibiotics leads to improved sensitivity (11). Iran is no exception to this global problem. Reports from Tehran showed that 57% of hospitalized patients received antibiotics (8). In addition, there are studies showing that more than 37% of antibiotics were inappropriately prescribed (12). Therefore, it seems necessary to implement new and more effective policies to control the inappropriate use of antibiotics, internationally (13-15).

Being fully aware of the details of antibiotic consumption and patterns of antibiotic prescription is of cardinal importance to be used as a basis for future interventional programs. Therefore, the present study was conducted in Imam Reza educational hospital, Mashhad, Iran with the aim of determining the status and pattern of antibiotic prescription.

Methods

This cross-sectional study was conducted between August 2014 and July 2015, at emergency department of Imam Reza hospital in Mashhad, Iran. Imam Reza hospital is an academic treatment center with approximately 250,000 entrances in year to its emergency department.

All patients admitted in the emergency department with triage levels of 1-3, who had a consultation with internal medicine, surgery, or infectious disease specialists and had at least 6 hours of stay, were included. The exclusion criteria were: a) lack of consent to hospitalization and receiving treatment, b) patients without a definite primary diagnosis.

During the course of treatment, demographic characteristics, clinical symptoms on admission, antibiotic regimens prescribed (including type and dosage), and changes in the treatment regimen were investigated.

The sample size was determined with an alpha error of 5% with power of 80%. Finally, the data was collected from 540 patients by a checklist and were imported into SPSS software (version 11.5 for Windows, SPSS Science, Apache Software Foundation, Chicago, IL, USA) after being verified and corrected.

Quantitative data were described by mean ± standard deviation (SD), while frequency and frequency percentage was used for qualitative data. T-Student test or One Way ANOVA were applied for quantitative variables and Chi-Square test was used for qualitative variables. In cases of non-normally distributed variables, appropriate non-parametric tests were applied. All tests with a P-value < 0.05 were considered as statistically significant.

Results

Records of 540 patients, who qualified for the study, were completely analyzed. The mean age of the patients was 58.9 ± 19.5 years and 60.4% were male. Only 19 (5%) patients were transferred to hospital by pre-hospital emergency services. The most frequent chief complaints on admission were related to the gastrointestinal tract (details are shown in Figure 1).

The mean age of the patients admitted to surgery service (42.3 ± 21 years) was significantly lower than the patients admitted to the internal medicine (60.6 ± 18 years) and infectious diseases (60.1 ± 21 years) services (P < 0.001). No significant difference in gender distribution between the various services patients was observed (P = 0.3).

Patients requiring more long-term hospitalization were provided with a consultation according to the request of the emergency medicine physicians. Most frequent consultation requests were sent for specialists of internal medicine (433; 80.2%), followed by infectious diseases (66; 12.2%) and surgery (38; 7%).

No significant difference was observed regarding sex, age, or referral to the emergency department by Emergency Medical Service between the patients who received antibiotics and those who did not.

In this study, 379 patients received at least one antibiotic prescription, among whom 323 (85.2%) received cephalosporins and 128 (23.8%) received macrolides. Table 1 shows the frequency of antibiotics prescribed by different consultant services (internal medicine, surgery, and infectious diseases).

Figure 2 shows the change in the patients' prescribed antibiotic(s). As shown, 227 cases (60%) had a change in

Figure 1: Chief complaint categorized based on initial presentation to the emergency department
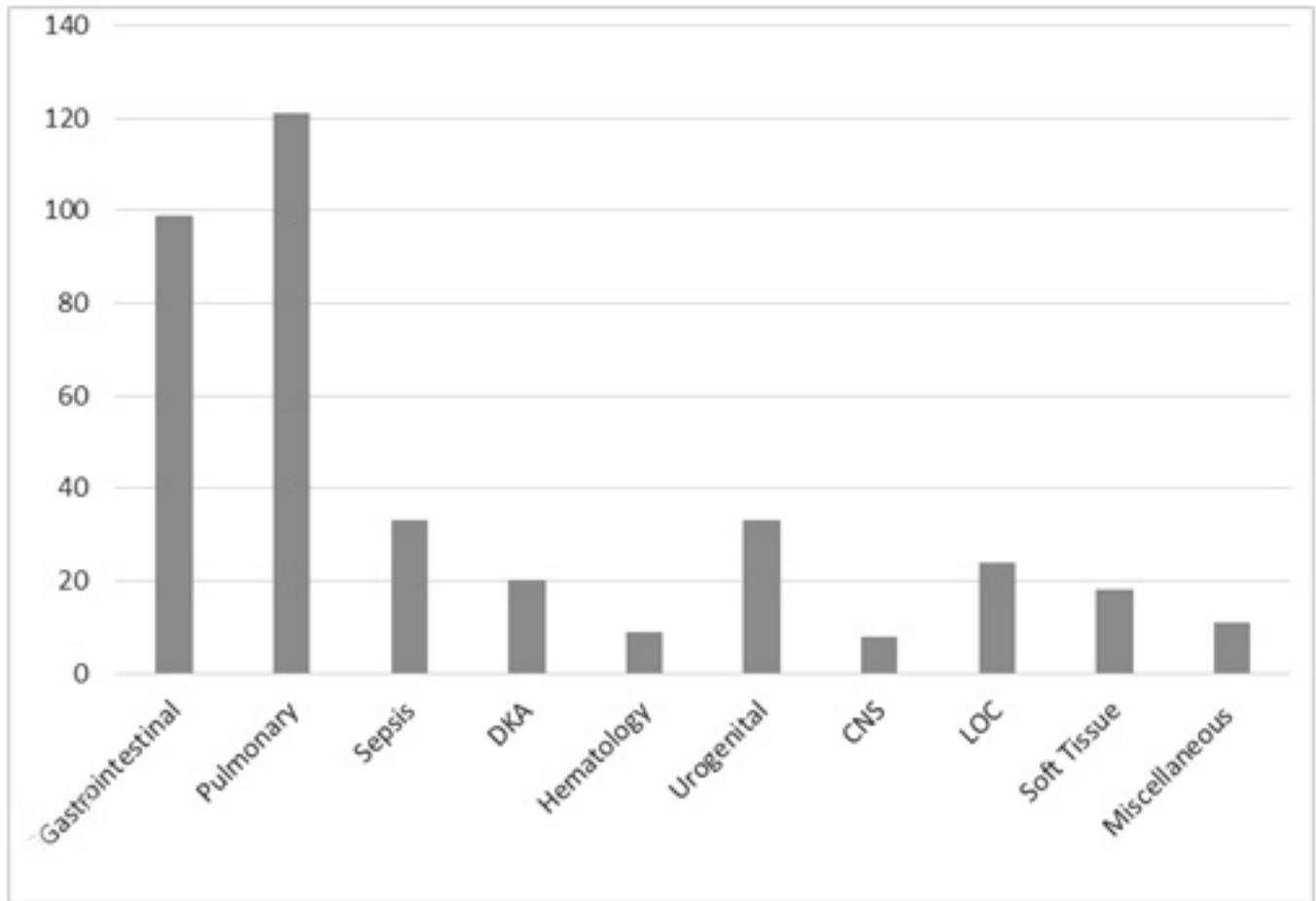

Figure 2: The frequency of administration of antibiotics for hospitalized patients in the emergency department
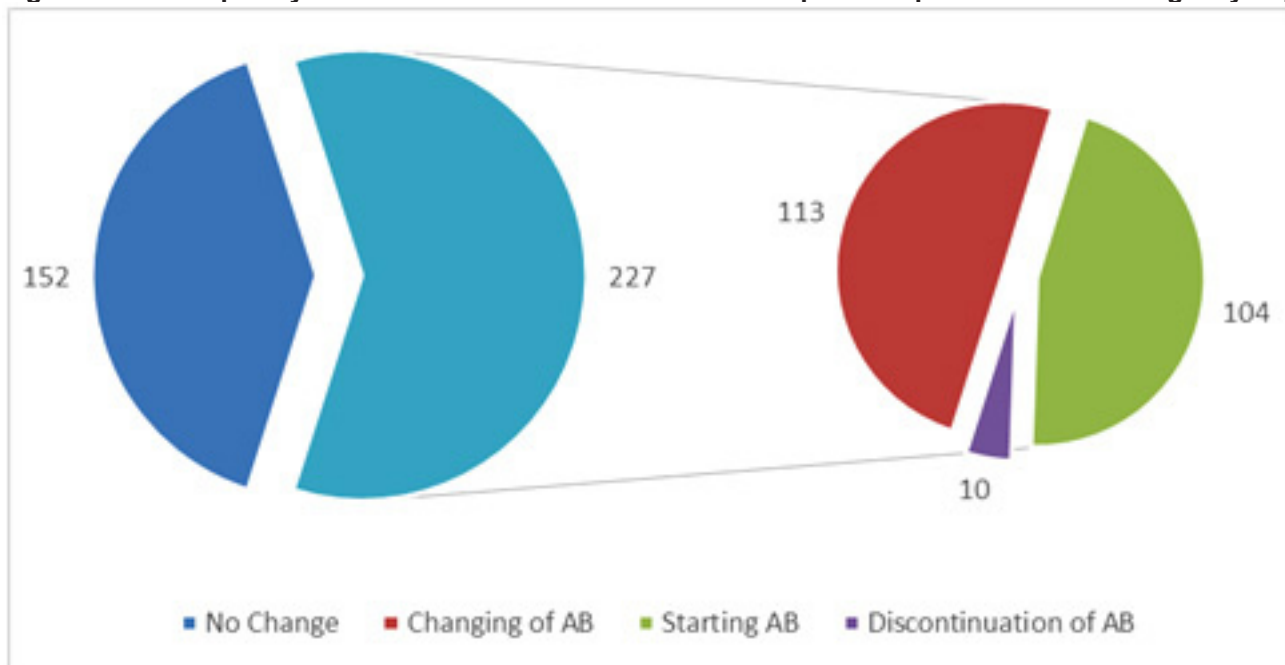
Table 1: Frequency of administration of various antibiotics by different specialties

Antibiotic	Emergency Medicine	Internal Medicine	Surgery	Infectious Diseases
Macrolide	81 (8.17) *	85 (19.7)	0 (0)	12 (11.7)
Cephalosporin	232 (51)	195 (45.1)	30 (53.6)	33 (32)
Carbapenem	19 (4.2)	49 (11.3)	0 (0)	9 (8.7)
Penicillin	38 (4.8)	21 (4.9)	1 (1.8)	16 (15.5)
Quinolones	23 (5.1)	29 (6.7)	0 (0)	11 (10.7)
Aminoglycoside	1 (0.2)	0 (0)	0 (0)	0 (0)
Vancomycin	25 (5.5)	18 (4.2)	0 (0)	16 (15.5)
Metronidazole	34 (7.5)	32 (7.4)	25 (44.6)	2 (1.9)
Acyclovir	2 (0.4)	3 (0.7)	0 (0)	4 (3.9)
Total	455 (100)	432 (100)	56 (100)	103 (100)

* Frequency (%)

their antibiotic administration status, including alteration in the type of prescribed antibiotic (113 cases; 50%), initiation of a new antibiotic (104 cases; 46%), and discontinuation of the prescribed antibiotic (10 cases; 4%). Among the alterations made in the type of prescribed antibiotics, 79 (70%) were done to achieve a higher range of efficacy, 21 (18.5%) was aimed at a less efficacious drug, and 13 (11.5%) were done to change the class of antibiotics. The majority of alterations were administered by internal medicine specialists. A hundred and eleven patients (30%) had at least one alteration in their antibiotic regimen. This change occurred once for 79, twice for 24, three times for 5, and four times for 3 patients.

Considering the change of antibiotics, the difference between the internal medicine and emergency medicine specialties was higher for three antibiotics (carbapenems, cephalosporins and quinolones). Internal medicine specialists tended to use wider spectrum antibiotics in 53 cases (71.6%). Concerning the change of antibiotics, the difference between the infectious diseases and emergency medicine specialists was higher for three antibiotics (carbapenem, cephalosporins and macrolides). The infectious diseases specialists also tended toward the use of wider spectrum antibiotics in 22 cases (62.9%). Concerning the change of antibiotics, the difference between the emergency medicine and surgeons was observed only in 3 cases. The surgeons in all these three cases tended toward the use of wider spectrum antibiotics.

Regarding the initiation of the antibiotics, the difference between the internal medicine and emergency medicine specialists was higher for three antibiotics (carbapenems, cephalosporins and macrolides). Gastroenterology and pulmonary medicine's involvement ranked first and second respectively, with 28 (34%) and 22 (27%) of cases. In this regard, the difference between the emergency medicine and infectious diseases specialists groups was observed only in 6 cases. Diabetic foot and sepsis, ranked highest with 3 (50%) and 2 (33%) cases, respectively. The

difference between the emergency medicine and surgeons was observed in 17 cases for the initiation of antibiotics. Involvement of the gastrointestinal system in 16 (94%) cases, ranked first among the reasons for prescribed medication.

With regard to the discontinuation of the antibiotics, the difference between the emergency medicine and internal medicine specialists was observed in 9 cases. Involvement of the gastrointestinal system with 5 (55%) cases, ranked first. Cephalosporins were the most frequent discontinued medication in 8 cases (89%). The difference in discontinuation of antibiotics between the emergency medicine and infectious diseases specialists was observed in only 1 case, for whom a macrolide was discontinued with impression of non-infectious lung disease. No discontinuation of antibiotics was observed in the surgical services.

No significant difference was observed in sex of the patient regarding the alteration status of antibiotics. Likewise, no difference was observed between different specialists regarding the change in the efficacy of antibiotics. No difference was observed regarding the alteration of antibiotics between most likely involved organs. In addition, mean age did not make any difference regarding start, discontinuation, or variation of antibiotics.

Introduction

During this study, at least one antibiotic was prescribed for 70% of patients, by one or multiple services. In 30% of cases, antibiotics prescribed by emergency medicine physicians were modified by other specialists. Moreover, we observed administration of new antibiotics in 28% of cases, and discontinuation of antibiotics in 2.6% of cases. This might be related to the differences in approaching methods or reference books of different specialists, alterations in the clinical course of patients in the emergency setting, availability of preliminary examinations, or considering

other possible diagnoses. However, such inconsistencies in practice can entail many unnecessary medical costs and prescriptions. For example, in a study in Brazil, 24% of the antibiotics prescribed were inappropriate (16). Another study from Latvia posits that most of the prescribed antibiotics were not based on proved indications, and that prophylaxis antibiotics had been prescribed more than the expected duration (17). In a study conducted by Erbay et al. 35.8% of the prescribed antibiotics were inappropriate (18). Therefore, having adequate knowledge of the indications of antibiotic therapy is not necessarily sufficient to make a change and antibiotic prescribing habits of physicians should be changed as well.

Antibiotic variations administered by internal medicine services were observed in 26.4% of cases while in 71.6% of them, the prescribed antibiotic was changed to one with higher coverage level. In most cases, antibiotics were changed once. Results of a study on patients hospitalized in an internal medicine ward in Mashhad revealed that in 94% of cases antibiotics had been inappropriately prescribed, which included selection of inappropriate antibiotic type, inappropriate prescribed medication dosage, or dosage intervals, duration of prophylaxis or treatment, and indication of antibiotic prescription (19). However, this rate has been reported to be 60% in another study (20).

In 55.6% of patients who had a visit by infectious disease specialists, antibiotics were changed, 62.9% of which tended toward the use of antibiotics with greater range of coverage. Similar to the internal medicine group, in most cases, antibiotics were changed once. Since sepsis and complications associated with CNS had the highest frequency, associating the clinical views of these two clinical specialist groups seems necessary in this regard. Since the majority of patients admitted to the emergency department with surgical problems are generally operated, the rate of alteration in antibiotic prescription by surgery specialists was not high. However, a study conducted in Rasht, Iran on patients with elective and emergency surgery, suggest that more than 30% of cases visited by surgeons had inappropriate antibiotic prescription; and antibiotics were prescribed in 30% of cases with inappropriate coverage levels. Furthermore, treatment duration had not been in accordance with appropriate principles of treatment in more than half of the cases (21). In another study conducted in Mashhad, inappropriate antibiotics were prescribed for 98% of patients admitted to a surgical ward (19).

Some studies have explained the use of antibiotics in health centers (22-26). Guidelines have been set with the aim of reducing the consumption as well as establishing appropriate and reasonable administration of antibiotics through the control of antibiotic use (27, 28). In a study by Senn et al. it was shown that reassessment of antibiotic prescription as a new solution can lead to improved administration of antibiotics (29).

In accordance with studies carried out in other parts of Iran, the results of this study also showed that the most commonly used antibiotic category in Iran is cephalosporins, which is probably due to its various generations and wide coverage level (8, 12, 19, 30).

In most studies, the importance of an infectious diseases consultation on appropriate antibiotic prescriptions has been noted (31, 32); similarly, this study showed a high rate of antibiotic alteration upon consultation with infectious diseases specialists. This might be due to the flaws in diagnosis of infections, or choosing proper antibiotic therapy by the primary visiting specialists.

Although few studies have been conducted on the consumption of antibiotics in Iran, none of them specifically examined the use of antibiotics in the emergency department. On the other hand, the strengths of this study are the sampling methods and administration of this project over a year. In addition, this hospital is the only University Hospital with an academic based emergency medicine department, which can also be listed as strengths of this study.

One of the limitations of this study is its retrospective design. Use of patients' medical records to retrieve data may cause biased information. However, since the antibiotics are rechecked by medical care team at the emergency department, the likelihood of such bias is weak. In addition, because Imam Reza Hospital is a referral based tertiary care center, the results of this study can be extended beyond the citizens of the city of Mashhad.

Conclusion

Antibiotic changes made by the infectious diseases specialists were more than the other services. Although providing all the patients in the emergency department with an infectious disease consultation seems impossible, development of medical and inter-divisional protocols for empirical administration of drugs in accordance with clinical symptoms and early diagnosis can be a valuable attempt. Prescription of cephalosporins, macrolides and carbapenems entailed the highest differences in terms of antibiotic discontinuation, initiation and alteration. The differences and inconsistencies between antibiotic prescription pattern of different specialists can be significantly reduced by periodic educational programs and review of the antibiotics prescribed for each patient. Arranging relevant educational workshops is strongly recommended, as it would be a necessary step toward achieving higher consistency and uniformity in the management of infections.

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