

PATTERN OF ANTIMICROBIAL PRESCRIBING AMONG IN-PATIENTS OF A TEACHING HOSPITAL IN YEMEN: A PROSPECTIVE STUDY

Abstract:

Antimicrobials represent one of the most commonly used drugs. Their irrational use leads to a number of consequences in term of cost, drug interactions, hospital stay and bacterial resistance, and a substantial economic burden on health care systems. This study aimed to investigate the pattern of antimicrobial use among hospitalized patients in different medical wards. A total of 384 admitted patients' treatment-charts were reviewed for antimicrobial prescribing. The majority of them were females (52.86%), most of the patients were from 1 to 16 years (59.63%) and intravenous injections remain relatively the common route of administration (99.7%). Most of patients were diagnosed as respiratory tract infections (30.21%) followed by gastrointestinal infections (19.53%), fractures & traumas were at the end of the order with 1.04% of the total diagnosis. Ceftriaxone (50.52%) was the top most frequently used antimicrobials followed by ampicillin (37.50%), Cefotaxime (16.15%), Cefuroxime (15.89%), Metronidazole (11.72%) and Amoxicillin/clavulanic acid (5.99%). The majority of the admitted patients (63.54%) received two or more antimicrobials in different combinations for their treatments while only 36.46% of patients treated by single antimicrobial drug. All the physicians agreed that clinical diagnosis is the important factor for determination of prescribed antimicrobials (100%), followed by other factors such as culture report, availability and cost of drugs (87.9%). 45.4% of physicians confirmed the influence of drug companies and their drug promotion on their antimicrobial prescribing.

Key words: antimicrobials, prescribing, ceftriaxone, Yemen.

Introduction:

Rational use of drugs is based on use of right drug, right dosage at right cost which is well reflected in the world health organization (WHO) definition: "Rational use of drugs requires that patients receive medications appropriate to their clinical needs, in doses that meet their own individual requirements for an adequate period of time, at the lowest cost to them and their community" ^{1,2}.

Appropriate drug utilization has a huge contribution to global reduction in morbidity and mortality with its consequent medical, social and economic benefits ^{3,4}. Inappropriate prescribing is known all over the world as a major problem of health care delivery. This is more so in developing countries where health budgets are small and 30 - 40 % of the total health budget is spent on drugs ^{3,5,6}.

Antimicrobials are one of the most common groups of drugs prescribed in hospitals ^{7,8}. It has been estimated that up to third of all patients received at least one antibiotic during hospitalization. AMs along with vaccines and oral rehydration salts represent potential agents in preventing mortality as well as morbidity ⁹.

Widespread usage of antibiotics in hospitals has also been associated with increases in bacterial strains and species that no longer respond to treatment with the most common antibiotics ¹⁰. Common forms of antibiotic misuse include excessive use of prophylactic antibiotics in travelers, failure of medical professionals to prescribe the correct dosage on the basis of the patient's weight and history of prior use, failure to take the entire prescribed course of the antibiotic and incorrect administration ¹¹.

Immethodical use of antibiotics has become a serious problem and even the world could finally return to the pre antibiotic era ¹². Over prescribing of antibiotics, not only increases the costs of health care, but may result in superinfection due to resistant bacteria, as well as opportunistic fungi, and may increase the likelihood of an adverse drug reaction ¹³.

It is impossible to introduce correct and rational use of antimicrobials without identification of current situation in their consumption¹⁴. Therefore, periodic assessment of the prescribing practices in health facilities will help to identify specific drug use problems and provide policy makers with relevant information that could be useful in review of policies of drug procurement and drug prescribing practices in the affected institutions and regions². This study aimed to evaluate the prescribing pattern of antimicrobials among hospitalized patients in medical wards and also find out the factors that influence prescribing in order to promote the rational use of antimicrobials.

Methodology:

This was a prospective descriptive study during the period of three months (February to April 2016) after obtaining approval from the institutional ethical committee of the teaching hospital at Tamar region, Yemen.

The treatment charts of 384 admitted patients who were receiving antimicrobial therapy in the medical wards of internal medicine, surgery, pediatric and gynecology departments were reviewed. The ICU patients, pregnant women and nursing mothers were excluded in this study. The wards of the hospital were visited daily by the research assistants and/or the researcher.

A standard form was designed for collecting patient details such as name, age, gender, date of admission, clinical diagnosis and specific issues related to antimicrobial use such as name of antimicrobials, their dosage schedule, route of administration and date of discontinuation. Each patient was followed on a daily basis until his/her discharge from the hospital. Furthermore, a questionnaire form was distributed for physicians regarding the most important factors that influence prescribing of antimicrobials in the hospital.

After necessary processing, all data were entered into the computer-based statistical programme - Statistical Package for the Social Sciences (SPSS), Version 20 for Windows for analysis. The processed data were analyzed accordingly.

Results:

A total of 384 admitted patients' treatment charts were reviewed. The majority of them were females (52.86%). Most of the patients were from 1 to 16 years (59.63%), followed by patients with age from 17 to 60 years (34.38%). The highest number of the admitted patients was from pediatric ward (60.15%), followed by equal number from surgery and medicine departments (16.93% and 16.15% respectively). **(Table 1)**

Parenteral intravenous injections remain relatively common route of administration (99.7%) of the reviewed patients chart. The most general diagnosis for patients was upper respiratory tract infections (30.21%), followed by gastrointestinal (19.53%) and neurological diseases (13.02%). Fractures & traumas were at the end of the ranking with 1.04% of the total diagnosis. **(Table 2)**

Moreover, the results revealed the great diversity antimicrobials used for the treatment of the admitted patients among medical wards. In this study, the top most frequently used antimicrobial was ceftriaxone (50.52%) followed by ampicillin (37.50%), cefotaxime (16.15%), cefuroxime (15.89%), metronidazole (11.72%), and amoxicillin/clavulanic acid (5.99%). **(Figure 1; Table 3)**

Hospital's physicians preferred to prescribe antimicrobials in combination for the treatment of the admitted patients. The majority of the admitted patients (63.54%) received two or more antimicrobials, 55.73% of them received two antimicrobials and 7.81% received three antimicrobials in combination, while the rest of the patients (36.46%) received single antimicrobial. **(Table 4)**

Regarding the physician questionnaire about the factors that affect prescribing of antimicrobials, the results showed that most contributing factor is the clinical diagnosis

(100%), followed by all of culture report, availability of drugs and cost of drugs (87.9%). 45.4% of physicians agreed on the influence of drug companies and their drug promotion on the antimicrobial prescribing. (Table 5)

Discussion:

The discovery of antibiotics is considered as one of the important medical achievements. Antibiotics had a tremendous impact on improving the life quality of human and represent one of the most commonly used drugs¹⁵.

Antibiotic resistance has been directly linked to high levels of antibiotic consumption within the community¹⁶. 30-50% of hospitalized patients receive at least one antibiotic for therapy or prophylaxis during their hospitalization. Also, there is evidence that antibiotics usage in hospitals is increasing, and that over a third of prescriptions are not compliant with evidence-based guidelines^{9,10,11,13}.

Several factors have appeared to be the reasons for irrational prescribing patterns such as the use of drugs that are not linked to the diagnosis, inappropriate dose and duration of therapy^{6,14} in addition to the self-medication by individual patients regardless of the causing pathogen¹⁷. This irrational use of antimicrobials leads to a number of consequences in term of cost, adverse drug interactions, hospital stay and bacterial resistance, and a substantial economic burden on health care systems⁷.

A study of prescribing patterns of antimicrobials is an effective way of reflecting appropriateness of antimicrobial use. A prescription provides an insight into a prescriber's attitude to the disease being treated and the nature of health care delivery system in a community and/or a country^{1,3,5,18}.

There are many studies related to antibiotic use in hospitals. The resulted data provide a constructive approach in solving problems arising from multiple antibiotic use^{19,20}. This study was done on the 384 hospitalized patients who admitted internal medicine, pediatric, surgery and gynecology departments in the teaching hospital in Tamar, Yemen, from February to April 2016.

The age distribution of patients showed that the age group from 1 to 16 years constituted 59.63% of the study population. No much variation between males (47.14%) and females (52.86%) was noted in the study population. These results are not compatible to the study conducted by Rosman *et al.*, 2007 in France and Netherlands where the mean age of study population was 50.5 ± 7.7 years²¹.

The high percentage of antimicrobials administered by intravenous route (99.7%) was consistent with other findings in which the injections are most common route of antibiotic administration in hospitalized patients. Also, it might be explained that doctors being under pressure to prescribe rapid-acting drugs to get fast improvement especially in acute infections^{6,7}.

Regarding the type of infections, our results were compatible with other studies that classified the upper respiratory tract diseases as the most common infection²⁰. Moreover, recent estimates indicate that 1.9 million children worldwide die each year from acute respiratory illnesses, many of which are lower respiratory infections as pneumonia²².

Ceftriaxone was the most frequently used antimicrobials (50.52%) followed by ampicillin (37.50%), cefotaxime (16.15%), cefuroxime (15.89%) and metronidazole (11.72%). The studies conducted in China and India were confirmed our findings and illustrated that cephalosporins were the most prescribed^{5,20,23}. Conversely, this ranking was not consistent with the pattern of antimicrobial use observed in other studies which found that macrolides were the most prescribed class of antibiotics^{24,25}. In addition, Vivekkumar *et al.* found that metronidazole is the most prescribed⁴.

The highest prescribing of cephalosporins in this study could be attributed to their broad spectrum of activity against most gram-positive and gram-negative bacteria, including several

strains resistant to other antibiotics, and recommended for serious infections caused by susceptible microorganisms^{6,26}. Metronidazole also prescribed in higher rate because it is the drug of choice in the treatment of anaerobic bacterial infections²⁶.

Although, ceftriaxone with fluoroquinolones and macrolides consider the preferred antimicrobials for respiratory tract infections - that were the most diagnostic diseases in the current study-, this high prescribing rate of ceftriaxone in the presence of other available, low-price and suitable antimicrobials reflect irrational prescribing of drugs and this may be responsible on developing resistance from microbes against ceftriaxone and other cephalosporins. There are many contributing factors for this irrational prescribing such as the wide available trade names of ceftriaxone in Yemeni market and this leads to competition between pharmaceutical companies to distribute them, in addition to increasing the temptations to physicians to prescribing ceftriaxone^{20,26}.

The majority of the admitted patients received two or more antimicrobials in different combinations (63.54%). This prescribing is a practice commonly observed in Yemen as well as in other regions^{6,20,21,27}. These findings are agreed with the study conducted in Nepal and other countries and also with the WHO guidelines^{6,7,28}.

The predominant use of a combination of antimicrobials may be due to the fact that physicians try to expand the possible spectrum of action of antimicrobials to include all expected microbes by prescribing combination with different mechanism of action and activity. The other reasons to such practices were probably the availability of drugs, its costs and the culture report^{6,20}.

On the other hand, these combinations have every possibility of producing more adverse reaction(s) and/or changing microbial ecology in addition to the increased costs of the therapy to the patients concerned as well as to the health care system⁸. Antonio da Cunha et al in Brazil showed that 28% of the antibiotic prescriptions for children with acute respiratory infection were inappropriate²⁷.

Finally, the results showed that most contributing factor that influences the prescribing is the clinical diagnosis (100%), followed by all of culture report, availability and cost of drugs (87.9%). These results are not consistent with the study occurred in Malaysia, which showed that drug availability (97.1%) and cost of drug (88.6%) are the most factors influencing the prescription of antimicrobials⁶. Moreover, 45.4% of physicians agreed on the influence of drug companies and their drug promotion on the antimicrobial prescribing. Actually, this is a mutual factor on prescribing all drugs and every company entices doctors to prescribe their products regardless the patient-need and the international therapeutic guidelines^{1,28,29}.

Conclusion:

On the light of the current results, it could be concluded that there is a polypharmacy, irrational, overuse and inappropriate use of antimicrobials. Ceftriaxone especially and cephalosporins generally were the most commonly prescribed antimicrobials. Clinical diagnosis, culture report and availability and cost of drugs are major factors influencing prescribing, although, the selection of antimicrobials may be the personal choice/preference for some physicians.

Additional studies on large scale in different health sectors are required to further explore patterns of antimicrobial prescribing and encourage periodic assessment of the sensitivity pattern of pathogenic organisms to avoid antimicrobial resistance. Also, there is an urgent need to develop strict policy for prescribing antimicrobials to improve perceptions and attitudes of physicians to play more active role in rational prescribing and to reduce the development of resistance.

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Conflict of interest:

No conflict of interest associated with this work.

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Tables and Figures:

Table 1: Demographic profile for patients.

Variables	Number of patients (n=384)	Percentage (%)
Sex:		
Male	181	47.14%
Female	203	52.86%
Age:		
1-16	229	59.63%
17-60	132	34.38%
>60	23	5.99%
Medical ward:		
Internal medicine	62	16.15%
Surgery	65	16.93%
Pediatric	231	60.15%
Gynecology	26	6.77%

Table 2: Distribution of patients based on the general diagnosis.

General diagnosis	No. of patients (n=384)	Percentage (%)
Neurological diseases	50	13.02%
Cardiovascular diseases	9	2.34%
Respiratory diseases	116	30.21%
Renal diseases	10	2.60%
Gastrointestinal diseases	75	19.53%
Metabolic diseases	10	2.60%
Hematologic diseases	6	1.56%
Endocrine diseases	23	5.99%
Infectious diseases	11	2.86%
Surgical states	42	10.93%
Fractures & traumas	4	1.04%
Others	28	7.29%

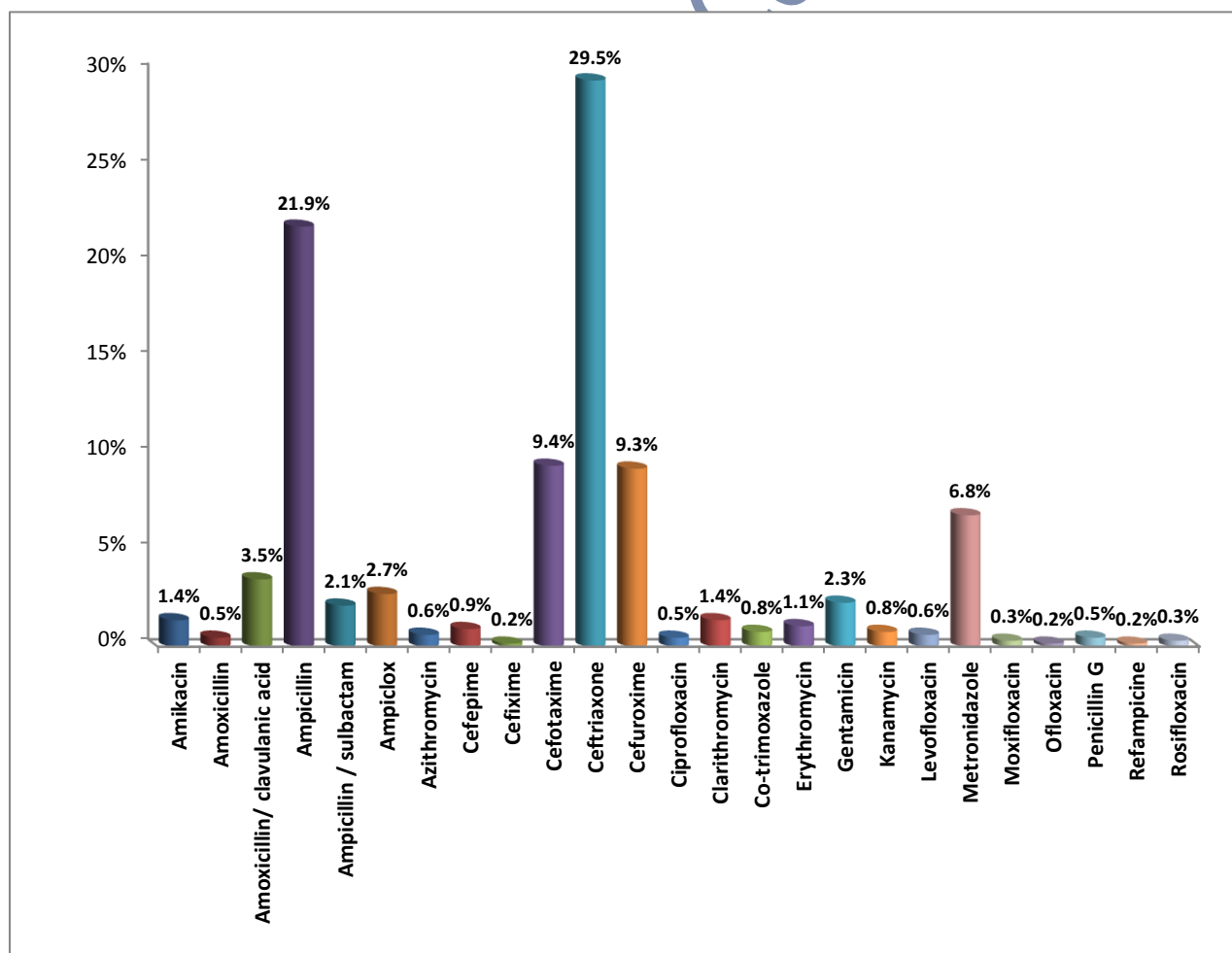


Figure 1: Prescribed antimicrobial agents.

Table 3: Distribution of antimicrobials according to medical wards.

Antimicrobials	Medical wards				Total (n=658)	
	Medicine	Surgery	Pediatric	Gynecology	No.	%
	No.	No.	No.	No.		
Amikacin	-	4	5	-	9	1.37%
Amoxicillin	2	-	1	-	3	0.46%
Amoxicillin /Clavulanic Acid	7	10	5	1	23	3.50%
Ampicillin	5	2	125	12	144	21.88%
Ampicillin/Sulbactam	-	-	14	-	14	2.13%
Ampiclox	-	-	17	1	18	2.74%
Azithromycin	-	-	4	-	4	0.61%
Cefepime	1	3	2	-	6	0.91%
Cefixime	-	1	-	-	1	0.15%
Cefotaxime	5	2	55	-	62	9.42%
Ceftriaxone	32	40	105	17	194	29.50%
Cefuroxime	11	10	40	-	61	9.27%
Ciprofloxacin	2	1	-	-	3	0.46%
Clarithromycin	4	-	5	-	9	1.37%
Co-Trimoxazole	1	1	3	-	5	0.76%
Erythromycin	1	6	-	-	7	1.06%
Gentamicin	-	2	13	-	15	2.28%
Kanamycin	-	1	4	-	5	0.76%
Levofloxacin	2	1	1	-	4	0.61%
Metronidazole	6	18	21	-	45	6.84%
Moxifloxacin	2	-	-	-	2	0.30%
Ofloxacin	-	1	-	-	1	0.15%
Penicillin G	3	-	-	-	3	0.46%
Rifampicin	1	-	-	-	1	0.15%
Rosifloxacin	-	-	2	-	2	0.30%
Vancomycin	3	-	13	-	16	2.43%
Ceftazidime	1	-	-	-	1	0.15%

Table 4: Antimicrobials according to the combination with others.

No. of prescribed antimicrobials (AMs)	No. of patients (n=384)	Percentage (%)
Single AMs	140	36.46%
Combination of two AMs	214	55.73%
Combination of three AMs	30	7.81%

Table 5: Factors influence prescribing of antimicrobials.

	Factor	No.	% (n=33)
1	Clinical diagnosis	33	100%
2	Culture report	29	87.9%
3	Feedback from patient responses	28	84.85%
4	Influence of drug companies (Medical representatives)	15	45.4%
5	Availability of drugs	29	87.9%
6	Cost of drugs	29	87.9%
7	Patient's demand	28	84.8%
8	In-service education	16	48.5%
9	Socio-economic status of patient	28	84.9%
10	Clinician's workload	21	63.7%

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