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RESEARCH ARTICLE

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

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Abstract

Objectives: The irrational use of antimicrobials 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.
Methods: The treatment-charts for 384 in-patients admitted to the major wards (medicine, surgery, pediatric and gynecology) in the teaching hospital and receiving antimicrobials were reviewed for the period from February to May 2016. The enrolled patients were observed from admission till discharge. Descriptive statistics were applied to the collected data and institutional ethical committee approval was obtained prior to the study. The majority of patients were females (52.86%), their age from 1 to 16 years (59.63%).
Results: The common diagnosis for patients was respiratory tract infections (30.21%) followed by gastrointestinal infections (19.53%). 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. 45.4% of physicians confirmed the influence of drug companies and their drug promotion on their antimicrobial prescribing.
Conclusion: The evidence of high prescribing rate of ceftriaxone in the presence of other available, low-price and suitable antimicrobials reflected irrational prescribing and this may be responsible on developing resistance against ceftriaxone and other cephalosporins.
Keywords: antimicrobials, ceftriaxone, prescribing, 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[1]. 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 super infection 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 consumption[14]. 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 regions[2]. This study aimed to evaluate the prescribing pattern of antimicrobials among hospitalized patients and also find out the factors that influence prescribing practice.

SUBJECTS AND METHODS

This was a prospective descriptive study conducted in the teaching hospital after obtaining approval from the institutional ethical committee of faculty of medicine at Thamar region, Yemen (TUMEC-16052). The treatment charts of 384 inpatients were reviewed during the period of four months (February to May 2016). The wards of the hospital were visited daily by the research assistants and/or the researcher[8].

Inclusion criteria

All admitted patients in the major wards (medicine, surgery, pediatric and gynecology) in the teaching hospital and receiving antimicrobial therapy.

Exclusion criteria

- The out-patients
- Patients who admitted to intensive care units.
- Patients who are not receiving antimicrobials.
- Pregnant and nursing mothers.

A standard Performa was designed for collecting patient details such as name, age, gender, and diagnosis, date of admission and date of discharge in addition to the specific issues related to antimicrobial use as name of antimicrobials, dosage schedule and route of administration[8]. A questionnaire related to the factors that contribute to prescribing practices were distributed to 33 clinicians who work in the teaching hospital. The identified ten factors were patient`s factors (demand and socio-economic status), prescriber`s factors (diagnosis, culture media lab report, in-service education, workload and feedback from patient), drug factors (availability and cost) and influence of industry (drug promotion)[6]. After necessary processing, all data were entered into the computer and using Statistical Package for the Social Sciences (SPSS), Version 20 for analysis. Chi square test was used to test the association between group variables. The level of significance was accepted at p value < 0.05.

RESULTS

A total of 384 admitted patients' treatment-charts were reviewed. The majority of patients were females (52.86%) and most of them were from 1 to 16 years (59.63%). The highest number of patients was admitted to pediatric ward (60.15%), followed by equal number from surgery and medicine wards (16.93% and 16.15% respectively) (Table 1). Parenteral intravenous injections remain relatively common route of administration (99.7%) of the reviewed patients chart. Moreover, the results revealed the great diversity of antimicrobials used for the treatment of the hospitalized patients.

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%

The most general diagnosis for patients was respiratory tract infections (30.21%), Followed by gastrointestinal (19.53%) and neurological diseases (13.02%). Fractures and traumas were at the end of the order with 1.04% of the total diagnosis (Table 2).

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

In this study, the top 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%) (Table 3). Hospital`s physicians preferred to prescribe antimicrobials in combination for the treatment of the admitted patients. The majority of them (63.54%) received two or more antimicrobials (55.73% of them received two antimicrobials and 7.81% received three antimicrobials), 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%) (Table 5).

Table 3: Distribution of antimicrobials according to medical wards.

Antimicrobials	Medical wards				Total (n=658)	
	Medicine	Surgery	Paediatric	Gynaecology		
	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

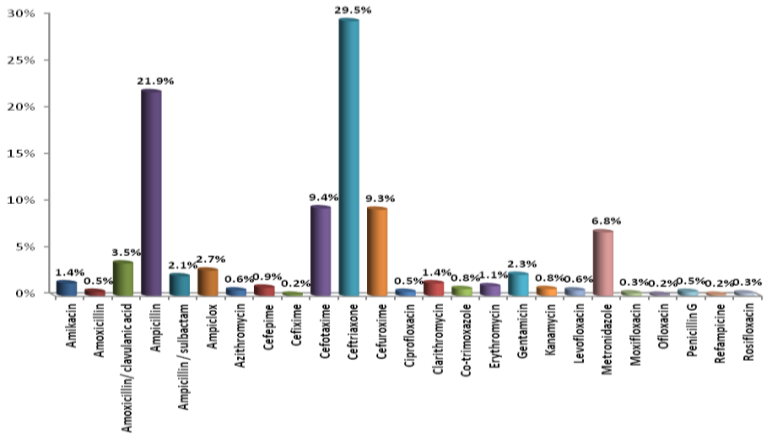

Figure 1: Prescribed antimicrobial agents.

DISCUSSION

The discovery of antibiotics is considered as one of the important medical achievements in the 20th century. Antibiotics had a tremendous impact on improving the life quality of human and represent one of the most commonly used drugs[15]. Antibiotic resistance has been directly linked to high levels of antibiotic consumption within the community[16]. About 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 pathogen[17].

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 systems[7]. A study of prescribing patterns of antimicrobials is an effective way of reflecting appropriateness 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 genecology departments in the teaching hospital in Thamar, Yemen, from February to May 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.

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

These results are not compatible to the study conducted by Rosman *et al.*, in France and Netherlands where the mean age of study population was 50.5±7.7 years[21].
The high percentage of antimicrobials administered by intravenous route (99.7%) was consistent with other findings in which the injections were most common route of antibiotic. 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 infection[20]. 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 pneumonia[22].

Table 5: Factors influence prescribing of antimicrobials.

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

Ceftriaxone was the most frequently used anti-microbials (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, Kumar *et al.*, found that metronidazole is the most prescribed[4]. The high 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[6,26]. Metronidazole also prescribed in higher rate because it is the drug of choice in the treatment of anaerobic bacterial infections[26]. Although, ceftriaxone with fluoro-quinolones and macrolides consider the preferred antimicrobials for respiratory tract infections that were the most diagnosis in the current study. Moreover, there are many contributing factors for this irrational prescribing such as the wide available trade names of ceftriaxone in Yemeni market that leads to competition between pharmaceutical companies to distribute them, in addition to increasing the temptations to physicians to prescribing ceftriaxone[20,26]. This prescribing is a practice commonly observed in Yemen as well as in other regions[6,20,26]. These findings are agreed with the study conducted in Nepal and other countries and also with the WHO guidelines[6,7]. The other reasons to such practices were probably the availability of drugs, its costs and the culture media lab report[6,20]. On the other hand, these combinations have every possibility of producing more adverse reaction(s) and/or changing microbial ecology[8]. Antonio da Cunha *et al.*, in Brazil showed that 28% of the antibiotic prescriptions for children with acute respiratory infection were inappropriate[27]. Finally, the results showed that most contributing factor that influences the prescribing is the clinical diagnosis (100%), followed by all of culture media Lab 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 antimicrobials[6]. 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 of other drugs because most of drug companies entice doctors to prescribe their products regardless the patient-need and the international therapeutic guidelines[1].

CONCLUSIONS

There is irrational and inappropriate use of antimicrobials. This practice may be leads to a number of consequences in term of cost, adverse drug interactions, bacterial resistance and a substantial economic burden on health care systems. Clinical diagnosis, culture media lab 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 to improve perceptions and attitudes of physicians to play more active role in rational prescribing.

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AUTHOR'S CONTRIBUTION

Al-Mehdar AA: writing original draft, methodology, investigation. **Al-Akydy AG:** formal analysis, data curation, conceptualization. All the authors approved the finished version of the manuscript.

DATA AVAILABILITY

Data will be made available on request.

CONFLICT OF INTEREST

None to declare.

REFERENCES

1. Amane H, Kop P. Prescription analysis to evaluate rational use of antimicrobials. Int J Pharma Bio Sci 2011; 2(2):314- 319.*https://doi.org/10.3329/jemc.v5i3.24747*
2. Hill DM, Sinclair SE, Hickerson WL. Rational selection and use of antimicrobials in patients with burn injuries, review article, clinics in plastic surgery 2017; 44(3):521-534.*https://doi.org/10.1016/j.cps.2017.02.012*
3. Tamuno I, Fadare JO. Drug prescription pattern in a nigerian tertiary hospital. Tropical J Pharm Res 2012; 11 (1):146-152.*https://doi.org/10.4314/tjpr.v11i1.19*
4. Kumar VSP, Aswin A, *et al*. Antimicrobial drugs usage in a tertiary care hospital - a descriptive study. Int J Pharmacol Res 2015; 5(10):231-235. *https://doi.org/10.7439/ijpr.v5i10.2440*
5. Yuan-Yuan W, Ping D, Fang H, Dong-Jie L, Yuan-Ying J. Antimicrobial prescribing patterns in a large tertiary hospital in Shanghai, China. Int J Antimic Ag 2016; 48(6):666-673. *https://doi.org/10.1016/j.ijantimicag.2016.09.008*
6. Akter SFU, Rani MFA, Rahman JA, Nordin MS, Awang MB, Rathor MY, Aris MAB. Antimicrobial use and factors influencing prescribing in medical wards of a tertiary care hospital in Malaysia. Int J Sci Environ Tech 2012; 1(4):274-284.*https://doi.org/10.1.1.301.8261*
7. Woldu MA, Suleman S, Workneh N, and Berhane H. Retrospective Study of the Pattern of Antibiotic Use in Hawassa University Referral Hospital Pediatric Ward, Southern Ethiopia. J App Pharm Sci 2013; 3(2):093-098. *https://doi.org/10.7324/JAPS.2013.30216*
8. Adiga MNS, Alwar MC, Pai MRSM, Adiga US. Pattern of antimicrobial agents use in hospital deliveries: A prospective comparative study. Online J Health Allied Scs 2009; 8(4):10.
9. Gerber JS, Newland JG, Coffin SE. Variability in antibiotic use at children's hospitals, Pediatrics 2010; 126(6):1067-1073.*https://doi.org/10.1542/peds.2010-1275*
10. Vlahovic´-Palc˘evski V, *et al*. Benchmarking antimicrobial drug use at university hospitals in five European countries. Clin Microbiol Infect 2007; 13:277-283. *https://doi.org/10.1111/j.1469-0691.2006.01613.x*
11. Davey P, Brown E, *et al*. Interventions to improve antibiotic prescribing practices for hospital inpatients. Cochrane Data Syst Reviews 2013;4.CD003543. *https://doi.org/10.1002/14651858.CD003543.pub4*
12. Davoudi A, Najafi N, *et al*. Evaluation of antibiotic prescription pattern in Fatimah Zahra heart hospital of Sari, at north of Iran; one year survey. Int J Med Invest 2013; 2(3):143-150.
13. Rolain JM, Canton R, Cornaglia G. Emergence of antibiotic resistance: need for a new paradigm. Clin Microbiol Infect 2012; 18(7):615-616. *https://doi.org/10.1111/j.1469-0691.2012.03902.x*
14. Hashemi S, Nasrollah A, Rajabi M. Irrational antibiotic prescribing: a local issue or global concern?, Experimental and Clinical Sciences. Int J. 2013; 12:384-395. PMID: 26622211
15. Chopra I. The 2012 Garrod Lecture: discovery of antibacterial drugs in the 21st century. J Antimicrob Chemo 2012; 68(3):496-505. *https://doi.org/10.1093/jac/dks436*
16. Williams KJ. "The introduction of 'chemotherapy' using arsphenamine - The first magic bullet. J R Soc Med 2009; 102(8):343-348. *https://doi.org/10.1258/jrsm.2009.09k036*
17. Aminov RI. A brief history of the antibiotic era: lessons learned and challenges for the future. Front Micro 2010; 1:134. *https://doi.org/10.3389/fmicb.2010.00134*
18. Abasaeed AE, Vlcek J, *et al*. A comparative study between prescribed and over-the counter. Saudi Med J 2013; 34 (10):1048-1054.
19. Remesh A, Salim S, Gayathri AM, Nair U, Retnavally KG. Antibiotics prescribing pattern in the in-patient department of a tertiary care hospital. Arch Pharma Practice 2013; 4 (2):71-76. *https://doi.org/10.4103/0976-500X.95527*
20. Kancherla D, Sai SMV, Devi GHJ, Sharma SA. Study on prescribing pattern of antibiotics in respiratory tract infections in a tertiary care center. Int J Rec Scient Res. 2015; 6(6):4558-4563.*https://doi.org/10.1086/520145*
21. Rosman S, Valliant ML, Clerc P, Vaherji R, Fleury NP. Prescribing patterns for upper respiratory tract infection in general practice in France and in the Netherlands. Europ J Public Health 2007; 1-5. *https://doi.org/10.1093/eurpub/ckm118*
22. Klig JE, Shah NB. Office pediatrics: current issues in lower respiratory infections in children. Curr Opin Pediatr; 2005; 17(1):111-118. *https://doi.org/10.1097/01.mop.0000150599.31091.f0*
23. Bhimavarapu R, Bhavna P, *et al*. A prospective study on antibiotic prescribing pattern among hospitalized patients in tertiary care hospital. Int J Res Pharm Nano Sci 2012; 1(2):147-158.*https://doi.org/10.18203/2319-2003.ijbcp20191599*
24. Maniar M, Shah I, Rao S. Antibiotic prescription patterns in children for upper respiratory tract infection and diarrhea. JK Science 2013; 15 (2):77-81.
25. Cantrell R, Young AF, Martin BC. Antibiotic prescribing in ambulatory care settings for adults with cold, upper respiratory tract infections, and bronchitis. Clin Therap 2002; 24(1):170-182. *https://doi.org/10.1016/S0149-2918(02)85013-5*
26. Deck DH, Winston LG. Chemotherapeutic drugs. Section VIII. Chapter 43-47, 789-848. In: Katzung BG. Basic and Clinical Pharmacology, 12th edition. 2012; McGraw-Hill, USA, ISBN.
27. Antonio ad Cunha. Inappropriate antibiotic prescription to children with acute respiratory infection in Brazil. Indian Ped 2003; 40:7-12. *https://doi.org/10.1007/BF02731121*