

Original Article

Inpatient antibiotics pharmacology and physiological use in Hayatabad medical complex, Pakistan

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Abstract: Antibiotics are used commonly and as powerful medicines, it well known that they affect the variety and composition of the microflora which has important physiological roles, therefore and for other health complications, the aim of the current study was to evaluate and estimate the appropriateness of antimicrobial drugs use in Hayatabad Medical Complex (HMC), Peshawar, Pakistan. The present work is based on the hospitalized patient's case studies. Individual patients were interviewed using the prepared questionnaire for the study. All hospitalized patients who received antibiotics were evaluated by a cross-sectional study. The total number of patients interviewed was 270 in medical department. According to our study in medical department, for prophylaxis 64.3% of antibiotic was used, whereas, an empirical use was 35.7%. Prodigious double regimen of antibiotics was observed throughout the study. The most prescribed antimicrobial group is penicillin and followed by tetracycline, macrolides, quinolones, and cephalosporin. Furthermore, 14.56% antibiotics were prescribed on generic name and 85.43% were prescribed on the basis of brand names. Taken together, the antibiotic use in medical department was unsatisfactory and irrational. In summary, in order to protect the physiological functions of flora microorganisms, a combination of both limitation, continuous education of physicians and elaboration of local guidelines appear to be necessary to improve rational antibiotic use.

Keywords: Irrational antibiotic use, rational use, drug resistance, empirical, prophylaxis

Introduction

The physiological and pathological importance of resident bacteria on a host is well reported, the microorganisms perform useful functions, such as metabolic activities, fermentation unused energy substrates, Thereby, regulating the development of the gut by its tropic effects on intestinal epithelia. Helping in immune system structure and function, interacting with human cells, including those of the immune system for training it to recognize and find out the antigens and protection of the colonized host against invading and growth of harmful pathogenic bacteria. Ability to produce vitamins B₁₂ [1] and K, which activates hormones to help the host to store fats. However, in certain states, some species are thought to be able to promote disease [2, 3]. The composition of the

microflora and interference activity was affected slightly, transiently and quantitatively diminished by Tetracycline and a significant quantitative and qualitative decrease by Penicillin, the decrease in interference activity continued up to 3 weeks after therapy. Although these effects are transient, results indicated the possibility of penicillin therapy to enhance susceptibility of certain individuals to subsequent infection with group A streptococci [4]. Also they affect the red blood cells, and should be used with caution. Antibiotics are one of the most prescribing agents in hospitals for infectious purposes [5].

Worldwide more than 50% of all antibiotics are prescribed, dispensed or sold inappropriately, while 50% of patients fail to take them accurately [6]. Economics, political opinions, physician's knowledge and know-how, diagnostic

ambiguity, and pharmaceutical marketing lead to the irrationality of antibiotics [6]. Irrational use of antibiotics cause appearance and propagation of resistant micro-organism, significant adverse effects such as increase the mortality and morbidity rate, increase the hospitalization duration, increase the risk of drug toxicity, greatly affect the cost factor, enhance the problem of drug resistance, and with a couple of other problems [7, 8]. Educational hindrance directed at patients and physicians can raise patients' consciousness and can also decrease the frequency of irrational antibiotic prescription by the doctors [8]. Several studies have been reported that patients' beliefs or doctor's perceptions of those beliefs affect the doctor's prescribing behaviour [9]. In fact, prescribing techniques for antibiotics do not always confirm the criteria for rational antibiotics use and can be classified as inappropriate or irrational prescribing. Irrational prescribing may be regarded as "pathological" prescribing, where the aforementioned criteria are not satisfied [10]. The other factor for irrational antibiotic use is the sale of antibiotics without prescription. While on the other hand, rational use of drugs necessitate that patients receive medications to their clinical needs, in doses that meet their own individual requirements for an adequate period of time, and the lowest cost to them and their community. The needs for appropriate medications will be satisfied if the practice of prescribing is properly followed. This will invariably help in eradicating in crucial patient's trouble (or diagnosis); in defining effective and safe and sound treatments (drugs and non-drugs); in selecting appropriate antibiotic, its dosage and duration, in writing a prescription, in giving patients adequate information, and in scheduling to assess treatment responses [10]. Previous Studies suggested reassessing of administered broad antibiotics which kill several bacterial species to evaluate the potential use of most targeted, narrow-spectrum antibiotics for the shortest period possible [11].

The aim of the current study was to evaluate the use of antibiotics. The study was carried out in HMC, Pakistan. In particular, we wished to study the quality, adequacy, and numbers of antibiotics prescribed by the doctors in medical department. The prescription amount was observed repeatedly in the current study. The antibiotics prescribed using generic and brand names were also taken under observation.

Materials and methods

The study was designed to evaluate the patient's prescriptions and medication history in HMC. Individual patients were interviewed using the prepared questionnaire for the study. The total number of patients interviewed was 270. The mean age was 38. The total number of medicines along with the other drugs was 1236. The prescriptions of antibiotic for the diagnosed diseases, the prescriber, and the antibiotics prescribed in each prescription with the generic and brand names were noted on the pre-designed data sheets. The antibiotic prescribed on the basis of microbial sensitivity test results (MCST) was also recorded.

Selection of patients and data collection

Patients included in this study were of different age, diagnosed with respiratory track infections (RTI), (upper respiratory tract infections (URTI) (*pharyngitis, common cold, sinusitis*), lower respiratory tract infections (LRTI) (*pneumonia, bronchitis*), and Chronic diseases (*asthma*). The total number of patients interviewed and examined for the current study was 270. A set of prepared questionnaire was used with information about the patient bio-data, habits, socio economic status and occupations and medication case history, diagnosis laboratory test for the disease and the prescribed drug for the cure. The patients were interviewed at regular intervals. Verbal consent was taken from every patient before enrolling in this study.

Study variables of data

The study variables were; age, sex (male/female), smoking, occupations, clinical diagnosis, investigation carried out, antimicrobial prescribed, other drugs prescribed, brand name, generic name, cost of antibiotics.

Data analysis

During the analysis of data all dependent variables were calculated by using the sigma plot. The data were evaluated by SPSS software using student *t*-test and for applicable (multiple group comparisons), the data were subjected to one-way analysis of variance (ANOVA).

Results

In the current study 270 patients were interviewed. Almost every patient received antibiot-

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Table 1. Characteristics of study participants (N=number of patients)

Characteristics	%	N	
Male	88.8	240	
Female	11.11	30	
Habits	Male smokers	55.5	150
	Female smokers	0	0
	Male non-smokers	33.3	90
Occupation	Farmers	55.5	150
	Business	33.3	90

ics in the medical department. The total number of medicine including antibiotic prescribed was 1236.

Table 1 shows the characteristics of the patients of medical department. It was observed that 88.8% (n=240) were males and 11.11% (n=30) were female patients. The number of smokers were 55.5% (n=150) in male while the non-smokers were 33.3%. The maximum number of patients was farmer i.e. 150 (55.55%). According to the current study that, majority of the people observed illiterate.

The percent amount of antibiotics was appropriately 35.7%, which based on clinical proof of infection, not depending on culture results termed as "empirical", while the remaining 64.3% of antibiotics administered without proofs of infection termed as "prophylactic".

Figure 1. Demonstrating the total drugs prescribed in the medical department (**Figure 1A**). This illustrated that antibiotics are the highest prescribing drugs comparing with other drugs as shown in **Figure 1B**. The most commonly used antibiotics were β -lactam- β -lactamase inhibitor combinations (penicillin group) (47.36%) which is the most prescribed antimicrobial agent and followed by tetracycline (43.1%), macrolides (4.2%), quinolones (3.1%), and cephalosporin (2.1%), respectively. The percentage of tetracycline (43.15%) was chosen due to their broad spectrum antimicrobial and their anti-pneumococcal activity. Also the tetracycline is the cheapest among other antimicrobials.

Table 2. Described the antibiotics used with respect to age of the patients in percent. Most of the patients were found adults. The percentage of antibiotics of quinolones and macrolides were highly prescribed in case of old patients. The penicillin percentage was observed greater

in case of adults, whereas, macrolides and tetracycline were observed higher than the other types of antimicrobial agents in case of children.

Table 3. Describe the scrutiny of the antibiotics on the basis of diagnosis. The prescribed penicillin group amount was 52.6, 54.3, and 25 percent in upper respiratory tract infections (URTIs), lower respiratory track infections (LRTI), and in chronic diseases (asthma), respectively. While the macrolides were 13.15, 21.73 and 16.6 percent in URTI, LRTI and chronic diseases, respectively. The percentages of cephalosporin were 2.17% in LRTI, and 8.3% in chronic diseases. Similarly, the quinolones amounts were 5.43 and 8.3% in LRTI and chronic diseases. Whereas, the tetracycline were also count was very dominant in infectious disease as shown in **Table 3**. The cephalosporin and quinolones were zero count in URTI.

Figure 2A shows the amount of antibiotics regimen with respect to rout of administration. Whereas, **Figure 2B**, shows the percentage of antibiotics with respect to brand and generic names. Every prescription was contained antibiotics. The percentage of antibiotic used in each prescription was 67.50% (double antibiotic), 22.5% (triple antibiotic) and 10% (single antibiotic). The average figure of antibiotic per prescription was 46.11% where as the according to WHO standards it should be 20-30% [12, 13]. Orally prescribed antibiotics were (75%) while the injection preparations were 25%. The percentage of antibiotic prescriptions based on microbial sensitivity test results was zero percent. The current study is evidence for that mostly the antibiotics are prescribed without culture sensitivity test. While **Figure 1B** shows the quantity of antibiotics with respect to brand and generic name. It was noted that most of antibiotics were prescribed on the basis of brand name rather than generic name. Briefly, out of 46.11% the generic name amount was 14.56% while the amount of brand name was 85.43%. This proved that, there was no apparent control over the prescribing habits of physicians.

Discussion

Antibiotics are the most extensively used drugs in the developing (Pakistan) as well as in many developed countries [14-16]. However, this

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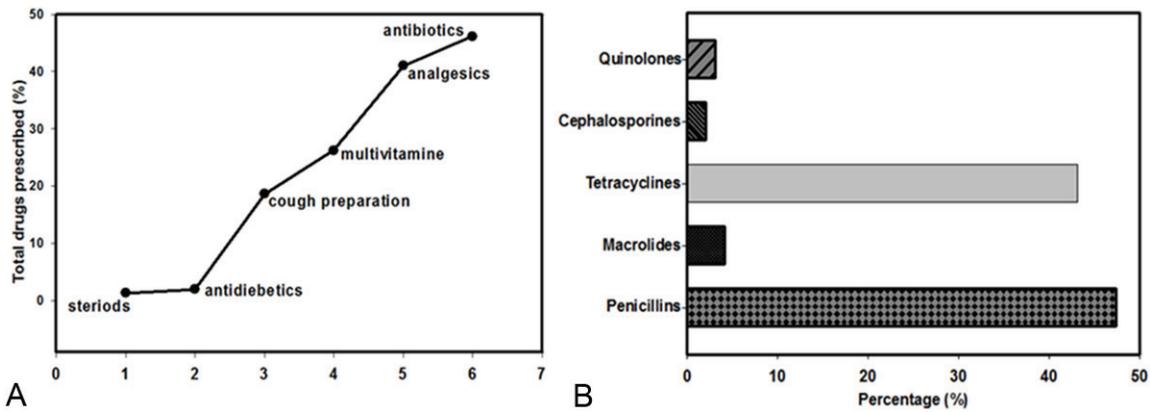


Figure 1. A: Detail of overall drugs prescription, B) The percentage of antibiotics prescribed per prescription in percent.

Table 2. The percent use of antibiotics with respect to with respect to age differences

Patient (age)	Patient (%)	Antibiotics (%)			
		Penicillins	Quinolones	Tetracyclines	Macrolides
Children (12~14 years)	6	24.4	0	37.7	37.7
Adults	60.6	74.8	7.44	10.25	7.44
Old	30	12.9	19.49	14.93	19.49

Table 3. Pattern of antibiotics distribution with respect to disease

Diagnose		Antibiotics (%)				
		Penicillins	Cephalosporins	Macrolides	Tetracyclines	Quinolones
Acute	URTI	52.6	0	13.15	34.2	0
	LRTI	54.34	2.17	21.73	16.3	5.43
Chronic		25	8.3	16.6	41.6	8.3

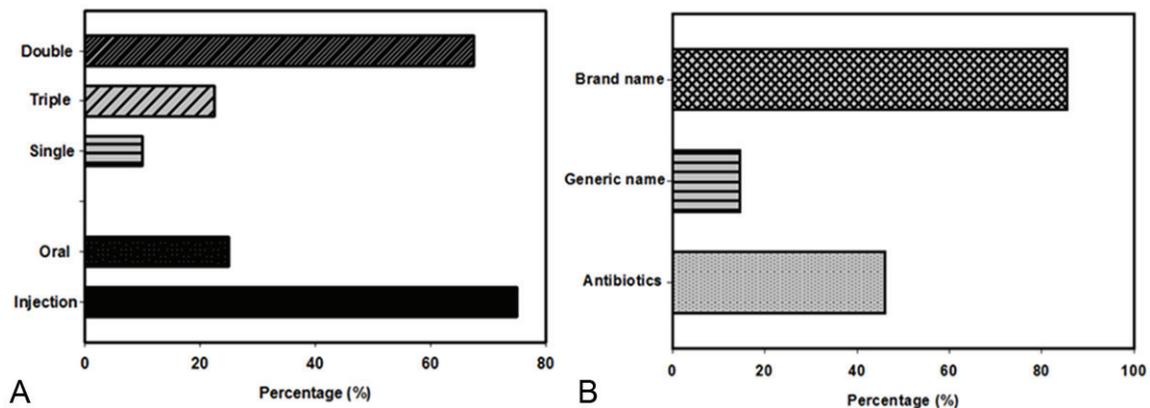


Figure 2. A: Antibiotics prescription on the basis of rout of administration and different regimen B) Percentage of antibiotics with respect to brand and generic name.

enlarged utilization of antibiotics is not always prescribed appropriately [5]. Misuse and progressively increasing antibiotic consumption play a vital role in the development of microbial

resistance all over the world [17]. In infants, the variety of gastrointestinal microflora has remained diminished eight weeks after antibiotic treatment while its number has returned to

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normal; this led to long negative effects on health particularly promoting the risk of developing asthma, allergy, and obesity [11]. The current study reported that all interviewed patients were prescribed antibiotics. The percentage of antibiotic used in each prescription was 67.50% (double antibiotic), 22.5% (triple antibiotic) and 10% (single antibiotic), respectively. The percentage of tetracycline (43.15%) was chosen due to their broad spectrum antimicrobial and their anti-pneumococcal activity. Also the tetracycline is the cheapest among other antimicrobials. The present study evaluated that the prescribers prescribed mostly latest generation of antibiotics with double and triple regimes as shown in (Figure 2A). As a result, these antibiotics generate resistance and patients need higher dose and generation [12, 18].

The relationship between antimicrobial use and resistance is at best circumstantial. Most studies of prescribing control or monitoring do not report susceptibility patterns as an outcome measure. The medical practitioners prefer wider spectrum antibiotics instead of single or narrow spectrum ones, even if they have few or no indications for which some other much less expensive antibiotic could not be used instead (e.g. cotrimoxazol, erythromycin, amoxicillin or ampicillin). This sort of an inclination has been observed in studies which are carried out in many other countries [16]. This alarm is a serious issue affecting the bacterial resistance harmfully besides increased costs. The hospital stay was also twice as long in these patients; this may increase the hospital infection risk and the cost of the treatment. Antimicrobial drugs represent a great part of the total yearly drug expenditures. In America, this rate is reported to be 20-40% [19-21]. Overall average antibiotics used were 46.11%, which is also the highest percentage in Asia, Africa, and other developing countries. In Bangladesh [12, 20] the averages stand at 25%. The high use of antibiotics in children (7.6% penicillin, 11.76% tetracycline, and 11.76% marcolides) was alarming as this can have devastating consequences by affecting the immune system of child and decreasing the body defence mechanism by producing resistance through disturbance of microflora function. This high use of antibiotics reflects poorly on the behaviour of physicians as a whole.

Antibiotics were used empirically if there was proof of any infection and for prophylaxis [22]. Various studies have demonstrated that administration of antibiotics to uninfected patients accounts for approximately 60% of irrational antibiotic use [23]. Our study showed that more antibiotics were used irrationally in empirical way, whereas, for prophylactic purposes the results of antimicrobial use were looked at 64.3% and empirical was 35.7% respectively. The frequent causes of irrational use were short treatment period, unnecessary use of antibiotics and recommendation of a more effective antibiotic [24, 25].

Antibiotic treatment is not always successful due to many factors related to drug or host. In such cases, the number of antibiotics may be increased, which increases both the treatment cost and the period in hospital [21].

The overall use of antibiotics by generic names was 14.56%, which is the lowest for most parts of the developing countries and doesn't compare favorably at all with Asian countries such as Bangladesh and Indonesia or even African countries i.e. Zimbabwe (94%), which stand at 78% and 59%, respectively [12]. This is in spite of the declared policy of the Government to promote generics drugs in all prescriptions, selection and procurement. The most important factor discouraging people from using generic drugs is their poor quality and efficacy. In Pakistan about 12000 to 20000 pharmaceutical products are registered and available in the market while around 300 pharmaceutical manufacturers are functioning in the absence of any effective drug control authority, which would exert a deterrent force on the defaulters [26]. This has led to an overall impression that generic drugs are of substandard and usually unreliable. The drug prescribers tend to use excessive brands of antibiotics available in the market and mostly physicians prescribed antibiotics in out-patients on brand name the most likely reasons could be the variation in the prices of the brands available and the activities of the marketing groups from the pharmaceutical industries or multinational biasness. The most probable reason for such prescribing is lack of a hospital formulary and pharmaceutical and therapeutic committee.

Hospitalization periods given single or two antibiotics were similar, but the hospitalization

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period of patients given three antibiotics was longer (**Figure 2A**). No significant difference of rational antibiotic use between the five groups was found (**Table 3**).

One of the most important factors is the choice of antibiotics for both cost and effective treatment [27, 28].

In order to prevent irrational use of antibiotics, some national control programmes should be carried out by the Ministry of Health. However, programmes such as postgraduate training are difficult to apply and need to run over a long period. Easier control programmes that include methods for restricting antibiotic use must be developed and implemented in hospitals where antibiotics are used frequently. Allocation of specialized training programs to raise awareness of the health risks, especially those related to physiological and immunological functions complications resulting from improper use of antibiotics. Education programs should be directed towards changing behaviour and attitude about the rational use of antibiotics. We suggest that strict precautions should be taken about irrational use of antibiotics and sale of antibiotics without prescriptions should be abandoned.

One of the methods used to control irrational antibiotic use is the restriction of culture sensitivity test reports. As a result, use of more expensive and more toxic antibiotics that need to be administered, especially in serious hospital infections are restricted [29]. Microbiology laboratories in hospitals should be able to identify all micro-organisms. Therefore, support of the microbiology laboratory is very essential. In our study there are no single patients who performed culture sensitivity test and no physician has advised for culture sensitivity test.

Conclusion

In summary, although antibiotic resistance is a daunting worldwide concern, changing local perceptions is a more realistic and attainable goal. By helping patients understand the importance of appropriate use, you'll be teaming up against resistance. This is the first step towards preserving, rather than reserving, today's viable antibiotic supply.

Irrational prescribing is a habit that is difficult to cure. However, prevention is possible. There

is some evidence that intervention such as short problem based training course in pharmacotherapy [30] and rational antibiotics use focused workshops [31] can improve the rational use of antibiotics. There is urgent need of training initiatives, with support from public sources to ensure that there is no conflict of interest to improve antibiotics prescription behaviour of physician in Pakistan and ensure that patient receives evidence based, cost effective treatment for their health problems.

Significance for public health

The current study demonstrates the irrational prescription and use of antibiotics in one of the Pakistan hospital. Worldwide more than 50% of all antibiotics are prescribed, dispensed or sold inappropriately, while 50% of patients fail to take them accurately. This study also shed light on the quality of prescriptions by medical practitioners, including both the hospitalized prescription and the type and number of drugs prescribed over the counter. There is a need to standardize the use of antibiotics in Pakistan so that all essential information is included. There is a need to strengthen an independent mechanism for continuing professional development of practitioners to ensure that patients are always given evidence-based, cost-effective treatments. In addition, combination of both limitation, continuous education of physicians and elaboration of local guidelines appear to be necessary to improve rational antibiotic use.

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