

Original Article

Rational Use of Antimicrobials to Preserve Sensitivity

DOI: dx.doi.org



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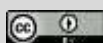
Received: 11 June 2023

Accepted: 25 June 2023

Published: 10 August 2023

Published by:

Sher-E-Bangla Medical College,
Barishal, Bangladesh



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**ABSTRACT**

Introduction: Antibiotic resistance has increased dramatically over the past 10 years. Antibiotics are commonly prescribed, leading to frequent overuse, which poses a risk of developing resistance and escalating expenses. Rational drug prescribing is essential for minimizing healthcare costs and for reducing resistance. This study aimed to assess the rational use of antimicrobials to preserve their sensitivity. **Methods and Materials:** This prospective study was conducted at the Critical Care Department in Bangladesh Shishu Hospital. The study duration was 1 year; from January 2021 to January 2022. The blood samples were taken for a sensitivity test. Necessary data were collected from the parents of the children by a pre-designed data collection sheet. Confidentiality of all data was maintained, and its utilization was solely confined to the purpose of this study. **Result:** Concerning the distribution of respondents according to sensitivity to antimicrobial agents, all patients 100.0% were resistant to amoxicillin, 49.0% were resistant, and 3.0% patients were sensitive to piperacillin, 27.0% were sensitive and 12.5% were resistant to ceftriaxone, 32.5% patients were resistant and 25.0% patients were sensitive to chloramphenicol. The tendency of self-medication was 40.0% of the total study population, followed by lack of public knowledge and awareness in 35.0% of patients, and access to antibiotics without prescription in 25.0% of patients. **Conclusion:** This study concluded that antimicrobial resistance was most

(The Planet 2022; 6(2): 431-437)

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prevalent in patients with low socio-economic status. Furthermore, to preserve the sensitivity of antimicrobials, rational use of antimicrobials should be ensured by addressing public knowledge and awareness, preventing access to antibiotics without prescription, and stopping the practice of self-medication.

Keywords: Antimicrobials, Rational, Sensitivity, Resistance

INTRODUCTION

Irrational use of medicines is a global problem. It has been estimated that less than half of all medicines are prescribed, dispensed, or sold inappropriately and that less than half of all patients take their medicines as prescribed or dispensed. Irrational use of medicines can harm patients in terms of poor patient outcomes, unnecessary adverse reactions, and waste of resources ^[1]. Antibiotics represent a class of highly cost-effective and life-saving medications that play a significant role in extending lifespan ^[2]. The process of inhibiting the growth of disease-causing microbes is termed antimicrobial activity, as depicted in Figure 8. These antimicrobial agents can be categorized as anti-bacterial, antiviral, or anti-fungal, each with distinct mechanisms to halt infections. The administration of antibiotics to individuals is generally guided by their sensitivity profiles. To determine the most suitable antibiotic for specific microorganisms, susceptibility testing is performed ^[3]. In accordance with the World Health Organization's (WHO) definition, rational medicine use encompasses patients receiving suitable medications for appropriate indications, at dosages aligned with their needs, over adequate durations, all at minimal costs to both individuals and society, and accompanied by pertinent information. The irrational or unnecessary utilization of

medicines arises when one or more of these criteria are not fulfilled ^[4].

Excessive and inappropriate use of antibiotics causes significant adverse effects such as an increase in morbidity and mortality, drug toxicity, long hospitalization period, an increase in costs, resistant microorganisms, and associated infections. The inappropriate use of antibiotics is more important in developing countries because of the freer marketing of antibiotics and the higher frequency of specific infectious diseases ^[5]. In children and young adults, infectious diseases are the world's biggest problems, causing more than 13 million deaths per year. A striking ninety percent of fatalities stem from six highly lethal infectious diseases, specifically: pneumonia, tuberculosis, diarrhea, malaria, and measles ^[6]. According to the results of various surveillance studies, the percentage of irrational antibiotics which was reported was 40-60% ^[7]. To ensure the rational use of drugs, a set of measures needs to be implemented. These measures encompass the development and periodic revision of the national essential drug list, the creation of a national formulary, amendments to the pharmacy act, raising awareness among people about the adverse outcomes of irrational antibiotic use, and the establishment of drug information centers ^[8]. The irrational and excessive utilization of antibiotics leads to an escalation in resistance against these treatments.

Antimicrobial resistance is a serious public health problem worldwide ^[9]. However, resistance to antibiotic treatment is increasing due to the continued selection of less-susceptible genetic variants in clinical and nonclinical environments. Resistant pathogens have the potential to trigger bacterial infections that pose significant treatment challenges, and novel resistance mechanisms may emerge as an evolutionary reaction to antibiotic therapy during infection ^[10]. Antimicrobial Resistance refers to the complete or partial loss of effectiveness of previously active antimicrobial agents against susceptible microbes. The surge in antimicrobial resistance (AMR) constitutes a worldwide health emergency, underscoring the urgent requirement for new antibiotic development. Inadequate antimicrobial practices, such as incorrect prescription adherence and unwarranted use of antibiotics ineffective against the specific disease, contribute to this crisis ^[3].

OBJECTIVES

General Objective

- To assess the rational use of antimicrobials to preserve their sensitivity.

Specific objectives

- To see the age distribution of the respondents.
- To know the socioeconomic status of the study subjects.
- To see the common resistant drugs.

METHODS AND MATERIALS

This prospective study was conducted at the Critical Care Department in Bangladesh Shishu Hospital. The study

duration was 1 year; from January 2021 to January 2022. A total of 200 patients were selected as the study population as per inclusion criteria. The blood samples were taken for a sensitivity test. Necessary data were collected from the parents of the children by a pre-designed data collection sheet. A descriptive method was used in this study. The confidentiality of all data was strictly maintained and limited to the scope of this study. Prior ethical approval was secured from the relevant institution. The statistical analysis of the findings was conducted using the Statistical Packages for Social Sciences (SPSS-25) software.

Inclusion Criteria

- Patients of <5 years of age
- Admitted patients in the critical care department
- Patients who had given consent to participate in the study.

Exclusion Criteria

- Patients who have hospital-acquired infection.
- Patients who did not give consent to participate in the study.

RESULTS

In this study, most of the patients (70, 35.0%) belonged to >1 year of age, followed by (54, 27.0%) 1-6 months of age (Table I).

Table I: Age distribution of the respondents (N=200)

Age	N	%
0-28 days	20	10.0
1-6 months	54	27.0
7-12 months	56	28.0
>1 year	70	35.0

In the present study, most of the patients (120, 60.0%) resided in urban areas, followed by (80, 40.0%) in rural areas. Regarding their parents' monthly income, 55.0% had an income of <15000 BDT and 45.0% had >15000 BDT (Table II).

Table II: Socioeconomic status of the participants (N=200)

Status	N	%
Residence		
Urban	120	60.0
Rural	80	40.0
Parents' monthly income (BDT)		
>15000	90	45.0
<15000	110	55.0

Concerning the distribution of respondents according to sensitivity to antimicrobial agents, all patients (200, 100.0%) were resistant to amoxicillin, followed by, 98 (49.0%) were resistant, and 6 (3.0%) patients were sensitive to piperacillin, 54 (27.0%) were sensitive and 25 (12.5%) were resistant to ceftriaxone, 65 (32.5%) patients were resistant and 50 (25.0%) patients were sensitive to chloramphenicol (Figure 1).

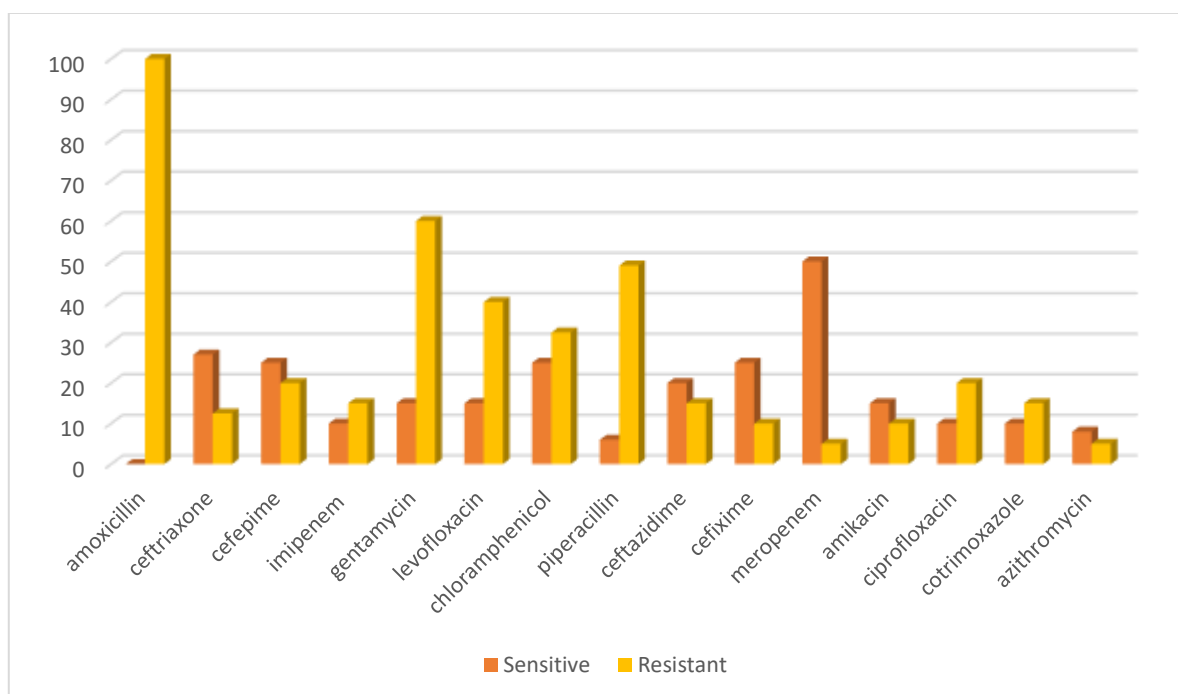


Figure 1: Distribution of patients according to sensitivity and resistance of antimicrobials (N=200)

This study showed that the tendency of self-medication was the most prevalent patient factor constituting 40.0% of the total study population, followed by lack of public knowledge and awareness in 35.0% of patients, and access to antibiotics without prescription in 25.0% of patients (Figure 2).

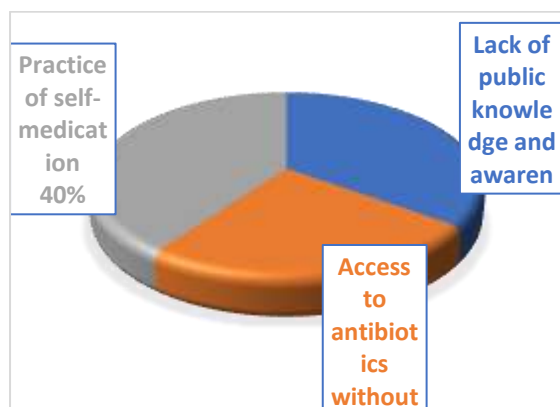


Figure 2: Patient factors of irrational use of antimicrobials (N=200)

DISCUSSION

In this study, most of the patients 35.0% belonged to >1 year of age, followed by 27.0%, 1-6 months of age. André M, Vernby Å, et al. observed a similar result in their study where most of the children belonged to >1 year ^[11]. In the present study, most of the patients 60.0% resided in urban areas, followed by 40.0% in rural areas. Regarding their parents' monthly income, 55.0% had an income of <15000 BDT and 45.0% had >15000 BDT. There are large differences between countries and social groups. The use of antibiotics is shown to be higher among those with a lower level of education (39% compared with 32–33%) and those in worse economic circumstances (44% compared with 31%) according to a study conducted by *European Commission* ^[12]. A study by Collignon P, Beggs JJ et al stated that a

reduction of antibiotic consumption will not be sufficient to control antimicrobial resistance because contagion—the spread of resistant strains and resistance genes—seems to be the dominant contributing factor. Improving sanitation, and increasing access to clean water should be taken care of ^[13]. Concerning the distribution of respondents according to sensitivity to antimicrobial agents, all patients 100.0% were resistant to amoxicillin, followed by, 49.0% were resistant, and 3.0% patients were sensitive to piperacillin, 27.0% were sensitive and 12.5% were resistant to ceftriaxone, 32.5% patients were resistant and 25.0% patients were sensitive to chloramphenicol. A high incidence

of resistance to amoxicillin (85%), and piperacillin (75%) was observed in a study by Piéboji JG, Koulla-Shiro S et al, portrayed a similar result to the present study. [14] This study showed that the tendency of self-medication was the most prevalent patient factor constituting 40.0% of the total study population, followed by lack of public knowledge and awareness in 35.0% of patients, and access to antibiotics without prescription in 25.0% of patients. Similarly, a Lithuanian study showed that two-thirds of participants had an insufficient level of knowledge about antibiotics and that participants tended to overestimate their knowledge, which may lead to increased non-adherence and self-medication ^[15]. Furthermore, unrestricted access to antibiotics without a prescription serves as a significant driver for the irrational use of antibiotics, stemming from potential difficulties in obtaining accurate diagnoses and proper diagnostic tools. This trend ultimately fosters the emergence and dissemination of antimicrobial resistance (ABR) ^[12]. A

survey conducted in the Algarve region of Portugal revealed that out of 1198 respondents, 7.5% indicated that acquiring antibiotics without a prescription was a straightforward process ^[16]. Leftover (remaining) antibiotics from earlier prescriptions facilitate the practice of self-medication. A study of the UK of 6983 households showed that 19% of those surveyed had a leftover drug. Prescriptions for >6 days constituted 61% of leftover drugs, whereas prescriptions for <3 days constituted 6% of leftover drugs ^[17]. So, take-back programs, including the return of unused or excess drugs to pharmacies, are recommended by the WHO ^[18]. Another study in India also observed that the high prevalence of resistant bacteria seems to be related to irrational antimicrobial usage: which includes 1) easy availability without prescription at drug stores, 2) injudicious use in hospitals, and 3) uncontrolled use in agriculture, animal husbandry, and fisheries. Ideal antimicrobial use involves the use of the correct drug by the best route in the right dose at optimum intervals for the appropriate period and after an accurate diagnosis. Moreover, it is highly recommended that practicing physicians should become aware of the magnitude of the existing problem of antimicrobial resistance and help in fighting this lethal threat by rational prescribing ^[19].

Limitations of the study

The study was conducted in a single hospital with a small sample size. So, the results may not represent the whole community.

CONCLUSION

This study concluded that antimicrobial resistance was most prevalent in patients with low socio-economic status. Furthermore, to preserve the sensitivity of antimicrobials, rational use of antimicrobials should be ensured by addressing public knowledge and awareness, preventing access to antibiotics without prescription, and stopping the practice of self-medication. So, providing education at all levels (community, healthcare, and individual) is essential to ensure the rational use of antibiotics and to preserve sensitivity.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

RECOMMENDATION

The national guideline provides the grounds for the rational use of antibiotics in the hospital to counteract antimicrobial resistance and to improve the quality of care for patients with infections by maximizing clinical outcomes while minimizing toxicity. Moreover, further studies should be conducted involving a large sample size and multiple centers.

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