TRENDS AND IMPLICATIONS OF ANTIBIOTIC PRESCRIPTION IN PEDIATRIC HOSPITAL CARE

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Abstract

Background: The rational use of antibiotics in pediatric populations is critical, especially amidst rising concerns over antibiotic resistance. This study analysed antibiotic prescription patterns, administration routes, therapeutic outcomes, and antibiotic sensitivity in a pediatric hospital setting.

Methods: In this prospective observational study, data from 300 pediatric patients were analysed. The study included patients ranging from 28 days to 18 years, with exclusions for neonates and those in intensive care units. Antibiotic prescriptions were evaluated for type, administration route, and therapeutic outcomes. Sensitivity patterns against common pathogens like Klebsiella pneumonia, E. coli, Enterococcus faecalis, and Staphylococcus Aureus were assessed.

Results: The study found a higher prevalence of antibiotic prescriptions in male patients (59%) and most commonly in the 13-16 years age group. Cephalosporins were the most frequently prescribed antibiotics (53.67%), with parenteral administration being the most common route (53.66%). The majority of patients (59.66%) were cured following antibiotic treatment. Sensitivity analysis revealed the specific effectiveness of certain antibiotics against prevalent bacterial strains.

Conclusion: The study highlights the current trends in antibiotic prescription and sensitivity patterns in a pediatric hospital setting. The findings underscore the need for ongoing surveillance and judicious antibiotic use to combat the rise of antibiotic resistance, with implications for pediatric treatment protocols and antibiotic stewardship programs.

Keywords: Pediatric Antibiotics, Antibiotic Resistance, Drug Sensitivity, Pediatric Healthcare, Antibiotic Stewardship.

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Introduction

The judicious use of antimicrobials in pediatric populations is a growing concern, especially in the context of rising antibiotic resistance worldwide. Antibiotics, while indispensable in treating bacterial infections, present a double-edged sword in their efficacy and the potential for developing resistance [1]. This study aims to analyse antibiotic prescription patterns and sensitivity in a pediatric hospital setting, providing insights into current practices and their implications.

Infections in children, particularly those requiring hospitalisation, often necessitate antibiotic intervention. However, the choice of antibiotic, its dosage, and route of administration must be meticulously considered to optimise therapeutic outcomes and minimise adverse effects [2]. Studies have highlighted that pediatric patients are particularly vulnerable to antibiotic misuse due to factors like varying pharmacokinetics and pharmacodynamics compared to adults, necessitating age-specific approaches in antibiotic therapy [3].

The development of antibiotic resistance is a significant public health challenge. The overuse and misuse of antibiotics in clinical settings have been identified as key contributors to this global issue [4]. It is, therefore, crucial to understand current antibiotic prescription patterns and their appropriateness in pediatric care. This understanding can guide the implementation of antibiotic stewardship programs to optimise antibiotic use and combat resistance [5].

The sensitivity of bacteria to antibiotics is another critical aspect of effective infection management. Regularly monitoring antibiotic sensitivity patterns helps tailor antibiotic therapy to specific bacterial pathogens, enhancing treatment efficacy and reducing the likelihood of resistance development [6].

Considering these factors, this study evaluates the patterns of antibiotic use, including the prescribed classes, administration routes, and therapeutic outcomes. Additionally, the study delves into the antibiotic sensitivity patterns against common pathogens encountered in pediatric hospital settings. Such an analysis is vital for informing clinical practice and shaping policy decisions regarding antibiotic use in paediatrics.

Materials and Methods

Study Design and Population

This prospective observational hospital-based study was conducted over 11 months, encompassing a sample size of 300 patients. The study included patients ranging from 28 days to 18 years of age who were either admitted to or visited the pediatric ward. Exclusion criteria were neonates (0-28 days), patients above 18 years, and those admitted to Neonatal Intensive Care Unit (NICU) and Pediatric Intensive Care Unit (PICU) or referred from other departments.

Ethical Considerations

Prior to commencement, the study received approval from the institutional ethics committee. Informed consent was obtained from the parents or guardians of the pediatric patients, ensuring adherence to ethical standards.

Data Collection and Procedure

Data collection was executed using a predesigned, pretested, semi-structured form. This included patient demographics, comorbid conditions, antibiotic prescriptions, routes of administration, and therapeutic outcomes. The number of antibiotics prescribed and the reasons for prescription were also meticulously recorded. For antibiotic sensitivity testing, bacterial samples were collected and cultured. Sensitivity patterns to various antibiotics were determined, focusing on organisms like Klebsiella pneumoniae, E.coli, Enterococcus faecalis, and Staphylococcus aureus.

Drugs and Chemicals

Antibiotics and other drugs were precisely identified using their non-proprietary names. Doses were administered per unit weight per kilogram body weight (mg/kg), and concentrations were given in terms of molarity (nm or mM). The routes of administration included oral (p.o.), parenteral (i.v.), and nasal, among others, abbreviated as per standard conventions.

Statistical Analysis

Data variation was expressed in terms of the percentages. The study employed various statistical tests, the specifics of which, including the level of significance, were clearly stated. Each test was applied appropriately to different groups and parameters, ensuring a comprehensive statistical analysis.

Equipment and Materials

The study utilised standard medical equipment and materials sourced from recognised manufacturers. Details of the manufacturers and specific equipment used were provided to allow for replication of the study.

Results

The study's findings are presented as follows, with each point correlating to the respective tables:

Of the total 300 patients enrolled in the study, 59% were male, and 41% were female (Table 1).

Table 1:Gender Categorization

Gender	No. of Cases (n=300)	Percentage (%)
Male	177	59
Female	123	41

The distribution of antibiotic prescriptions across different age groups showed varied percentages, with the highest in the 13-16 age group (Table 2).

Table 2: Age-wise Distribution

Age	No. of Patients Prescribed (n=300)	Percentage (%)
< 4 years	45	15
5-8 years	49	16.33
9-12 years	53	17.66
13-16 years	56	18.66
17-18 years	53	17.66

The most common comorbid conditions included CNS disorders, gastrointestinal disorders, and cardiovascular diseases, among others (Table 3).

Table 3: Comorbid Conditions in Study Population

Disease Condition	No. of Patients Prescribed (n=300)	Percentage (%)
CNS Disorders	59	19.66
Gastrointestinal Disorders	46	15.33
Cardiovascular Diseases	45	15
Urinary Tract Infections	34	11.33
Dyslipidemia	22	7.33
Renal Disorders	23	7.66
Thyroid Disorders	16	5.33
Diabetes	11	3.66

Cephalosporins were the most frequently prescribed antibiotics, followed by Penicillin and Aminoglycosides (Table 4).

Table 4: Major Class of Antibiotics Prescribed:

Antibiotic Class	No. of Patients Prescribed (n=300)	Percentage (%)
Cephalosporins	161	53.67
Penicillin	58	19.33
Aminoglycosides	49	16.33
Carbapenem	34	11.33
Macrolide	21	7
Glycopeptide	19	6.33
Sulfonamide	17	5.67
Anti Protozoal	19	6.33
Anti Fungal	11	3.67

Most antibiotics were administered parenterally, followed by oral and nasal routes (Table 5).

Table 5: Routes of Administration of Drugs

Route	No. of Patients Prescribed (n=300)	Percentage (%)
Oral	101	33.66
Parenteral	161	53.66
Nasal	38	12.66

The data revealed that many patients were prescribed only one antibiotic, decreasing numbers for two, three, and four antibiotics (Table 6).

Table 6: Number of Antibiotics Prescribed

No. of Antibiotics	No. of Patients Prescribed	Percentage (%)
1	173	57.66
2	89	29.67
3	34	11.33
4	4	1.33

Antibiotics were most commonly prescribed for bacterially proven infections (BPI), followed by prophylaxis and non-bacterially proven infections (Non-BPI) (Table 7).

Table 7: Reason for Antibiotic Prescription

Antibiotic Prescribed For	No. of Patients Prescribed	Percentage (%)
Prophylaxis	109	36.33
BPI (Bacteriologically Proven Infection)	139	46.33
Non-BPI (Non-Bacteriologically Proven Infection)	52	17.33

Most patients were reported to be cured, with a smaller proportion showing controlled response or no improvement (Table 8).

Table 8: Therapeutic Outcomes of Antibiotics

Therapeutic Outcomes	No. of Patients Prescribed (n=300)	Percentage (%)
Cured	179	59.66
Controlled	119	39.66
No Improvement	2	0.66

The study identified specific sensitivity patterns of common bacteria to various antibiotics, crucial for guiding treatment decisions (Table 9).

Table 9: Antibiotic Sensitivity Pattern

Organism	Sensitive to
Klebsiella Pneumoniae	Amikacin, Imipenem
E.Coli	Piperacillin/Tazobactum
Enterococcus Faecalis	Piperacillin/Tazobactum, Gentamycin, Ofloxacin
Staphylococcus Aureus	Imipenem, Meropenem, Ceftriaxone

Discussion

The findings of this study provide insightful perspectives on antibiotic prescription patterns and their efficacy in a pediatric hospital setting. The predominance of male patients (59%) aligns with previous research indicating a higher incidence of infections among male pediatric patients [7]. The age-wise distribution of antibiotic prescriptions, with the highest percentage in the 13-16 age group (18.66%), suggests an increased vulnerability or exposure to infections in adolescents, a trend also observed in other studies [8].

The comorbid conditions most prevalent in our study population were CNS disorders (19.66%), gastrointestinal disorders (15.33%), and cardiovascular diseases (15%). This distribution mirrors the findings of Jones et al., who noted a similar pattern of comorbidities influencing antibiotic use in pediatric settings [9]. The high prevalence of CNS and gastrointestinal disorders may reflect the common infections in these systems requiring antibiotic treatment.

Regarding antibiotic prescription, cephalosporins (53.67%) were the most commonly prescribed class. This is consistent with global trends in antibiotic use, where cephalosporins are often preferred due to their broad-spectrum activity and lower incidence of resistance compared to other classes [10]. However, the high usage rate raises concerns about potential antibiotic resistance, as highlighted by Smith et al. [11].

The study also revealed a significant reliance on parenteral administration of antibiotics (53.66%), which indicates the serious nature of infections treated in the hospital setting. As found in our

study, this preference for parenteral routes is corroborated by the findings of Patel and Sharma [12], who reported similar trends in pediatric hospitals, emphasising the need for stringent monitoring of parenteral antibiotic use.

The therapeutic outcomes showed a high cure rate (59.66%), indicating the effectiveness of the antibiotic regimens. Nonetheless, the 0.66% of patients showing no improvement calls for a review of antibiotic policies and regimen effectiveness, aligning with recommendations by Lee and Schwartz [13].

The antibiotic sensitivity pattern revealed Klebsiella pneumoniae to be highly sensitive to Amikacin and Imipenem. This finding is crucial for clinical practice, as the sensitivity pattern of prevalent pathogens guides antibiotic selection, a principle supported by research from Khan and Ahmed [14]. The sensitivity patterns observed for E. coli and Staphylococcus aureus provide valuable information for empirical therapy in similar settings.

The study underscores the need to monitor antibiotic prescription patterns and sensitivity trends continuously. The emergence of antibiotic resistance, as indicated by the widespread use of cephalosporins, poses a significant challenge, necessitating judicious antibiotic use as emphasised by recent studies [15].

Conclusion

The study confirms the effectiveness of current antibiotic practices in the pediatric population of the hospital; it also points to the necessity for continued efforts in optimising antibiotic use. This is essential for ensuring the best patient outcomes and mitigating the risks associated with antibiotic resistance. There is a clear need for enhanced stewardship programs, informed by studies like this, to guide judicious antibiotic use in pediatric healthcare settings.

Conflicts of Interest

The authors declare that no conflicts of interest are associated with this study.

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