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A Prospective Study on Cephalosporin Consumption Pattern at Trust-Based Tertiary Care Hospital

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Abstract: This study aimed to evaluate the Drug usage of 3rd generation cephalosporins and its effectiveness against particular diagnosis. A Prospective cross-sectional study was conducted at 40 Bedded Pediatric wards of Sukkur Blood Bank, Donating Society and Hospital, Sukkur to evaluate the antibiotic usage pattern among all admitted in-patients. Patients' demographic details were recorded from the Patient Bedside File (PBF). Data were analyzed using an excel sheet and Microsoft SPSS 20. Among all admitted patients, 1710 patients met the inclusion criteria and their PBF were evaluated for antibiotics. A total of 2155 cephalosporins were prescribed. The most commonly prescribed cephalosporins among the study population were Ceftriaxone 51.55% followed by Cefotaxime Sodium (26.50%). Among all, 74.34% pediatric patients were prescribed antibiotics through the parenteral route and 25.66% through the oral route. Antibiotics were being used without having any official national antibiotic policy or institutional protocols, which are currently lacking in the country. The study findings shall assist the health department and hospital management to devise the official guidelines to ensure rational usage of antibiotics. It is therefore recommended that the government should immediately address the irrational and overuse of antibiotics by implementing, national antibiotics policy, antibiotic stewardship programs, and training of healthcare staff. Novelty of this paper consists of collection of large-scale data, also data from diversified population was collected, as this study was conducted in public, private, and also charity-based hospitals.

Keywords: pediatrics, antibiotics, cephalosporins, consumption pattern, culture sensitivity test.

信托型三甲医院头孢菌素消费模式的前瞻性研究

摘要:

本研究旨在评估第三代头孢菌素的药物使用及其对特定诊断的有效性。在苏库尔血库、捐赠协会和医院的40个床位儿科病房进行了一项前瞻性横断面研究，以评估所有住院患者的抗生

素使用模式。患者的人口统计详细信息记录在患者床边档案(PBF)中。使用擅长表和微软SP
SS
20分析数据。在所有入院患者中，1710名患者符合纳入标准，他们的PBF接受了抗生素评估。总共开了2155种头孢菌素。研究人群中最常用的头孢菌素是头孢曲松51.55%，其次是头孢噻肟钠(26.50%)。其中，74.34%的儿科患者通过肠胃外途径服用抗生素，25.66%通过口服途径服用抗生素。在没有任何官方国家抗生素政策或机构规程的情况下使用抗生素，该国目前缺乏这些。研究结果将协助卫生部门和医院管理层制定官方指南，以确保抗生素的合理使用。因此，建议政府通过实施国家抗生素政策、抗生素管理计划和医护人员培训，立即解决抗生素的不合理和过度使用问题。本文的新颖之处在于收集了大量数据，还收集了来自不同人群的数据，因为这项研究是在公立、私立和慈善医院进行的。

关键词: 儿科，抗生素，头孢菌素，消费模式，培养敏感性试验。

1. Introduction

"Pediatrics is the specialty of medical science concerned with the physical, mental, and social health of children from birth to young adulthood" [1]. Microorganisms are a rich source of infections, which are populated in our environment. Antibiotics are widely used to treat bacterial infections, which are very common in children. Antibiotics prescribing has been a usual practice for treating pediatric illness [2]. Pediatric populations are more likely to contract illness [3]. The Major factors for contract illness and antibiotic use in pediatrics is the immune system, which is in the development stage is early childhood age and not fully functioning in this age. Second, children are also more vulnerable to have infections due to their daily routine life. Among other age groups, the antibiotic consumption in children must be careful. However, different antibiotics that are approved for adult age may not be desirable for children, so the interpretation of clinical data requires more vigilance [4]. Normally, pediatric prescription bears dose errors that requires to be monitored carefully for bettering the pediatric population [5]. Also, efforts must promote rational and judicious prescriptions to safe pediatric population from antibiotic resistance [6].

Low-income countries (LIC) face an increased load of infectious diseases, acute deficiency of medicines, and skilled healthcare professionals. There are chances of irrational prescribing and non-compliance of the patients, due to the shortage of medicines. Antimicrobial Resistance rates are more eminent in Low Income Countries (LIC) in comparison to high-income countries (HIC) and irrational prescribing trend is also higher in developing countries then developed world [7-8]. The eminent usage of antibiotics will increase the chances of antimicrobial drug resistance [9]. Antimicrobial resistance is a concern for the world and is conceived as a dangerous to the modern world therapy due to the potential of ineffective treatment regimens and pharmacoeconomic perspective [10]. Rationalization is the selection of moat appropriate medication for particular diagnosis as per patient requirement and standard guidelines [11].

The WHO and some other international organizations are very much concerned to address the issue of the irrational use of antibiotics. The worldwide campaign of Antibiotic Awareness Week started by the World Health Organization (WHO) can be quoted as an example for the public awareness regarding the irrational use of medicine. Prescribing patterns monitoring studies are conducted with a specific focus on prescribing, dispensing, and administration of the drugs. Prescribing competency portrays prescriber's knowledge, attitude, and practice toward disease diagnosis and disease management. Assessment of the antibiotic usage in the hospital can be conducted to govern their usage.

2. Methodology

2.1. Study Setting

A prospective cross-sectional study was conducted at 200 bedded Trust -based Tertiary Care Hospital Sukkur. This department is entitled for the facilities of pediatrics such as Pediatric Emergency, Neonatal ICU, Pediatric Surgery and Nursery. This hospital provides health facilities to surrounding districts such as Khairpur, Ghotki, Gambat, etc.

2.2. Study Population

Inpatients under 12 years of age, admitted to any of the pediatric wards of Sukkur Blood Bank, Donating Society and Hospital, Sukkur,

2.3. Inclusion Criteria

Pediatric/neonatal inpatients prescribed injectable

antibiotics alone/or in combination were admitted for at least 24 hours as inpatients.

2.4. Exclusion Criteria

All these patients, who were not meeting the inclusion criteria, were excluded from the study.

2.5. Data Collection

The patients were recruited in the study after attaining an informed assent form from parents, for reviewing their medication record. In-depth Interviews were also conducted after taking consent from Concerned Health Care Professionals. Patients' demographic details such as age, gender, complications at the time of admission, and final diagnosis were recorded from the Patient's Bedside File (PBF). The prescribed patterns of antibiotics were recorded. The prescriptions were categorized on the basis of prescribed antibiotic, alone or in combination. The initial therapy immediately after admission was recorded and categorized into Empirical, Prophylactic, and Targeted (without Culture Sensitivity Test), after consultation with prescribing Physicians/Consultants. The status of CST was recorded. The report of CST was followed from the Pathology Laboratory of the hospital [12].

2.6. Data Analysis

Details of drug therapy such as name of the drug, dosage form, frequency, route of administration, duration of treatment, a type of therapy (Empirical, Targeted or Prophylactic), the length of hospital stay, and the number of drugs per prescription were recorded from the patients bed side files.

2.7. Ethical Approval

This Study was approved by the "Ethical Review Committee" of the Hospital (Reference code 3740521AAPHA, June 29, 2021).

3. Results

Data were collected from 40 Bedded Pediatric department of Sukkur Blood Bank, Donating Society and Hospital, Sukkur from mid of June 2021 to mid of Dec 2021. During the study period, 2345 patients were admitted in the Pediatric Department. Among these, 1710 patients met the inclusion criteria and their PBF were evaluated for cephalosporins. The mean hospital stay was 3.81 (4.19). The demographic details of the patients are shown in Table.1. There were more male child patients than female child patients, (n = 982, 57.4 %) and (n = 728, 42.6%), respectively. The mean age of all patients was 2.96 +3.45 years, and their average weight was 6.30 kg. Children aged 01-05 years had the highest occurrence (n = 795, 46.5%), those aged 1day to 12 months amounted to n = 612, 35.8%, patients aged 5-12 years totaled n = 303, 17.7%.

Table 1 Gender and age distribution

Variable	N (Percentage)
Gender	
Male	982 (57.4)
Female	728 (42.6)
01 day ≥ 12 months	612 (35.8)
01 Year ≥ 05 Years	795 (46.5)
05 Years to 12 years	303 (17.7)
General Characteristics	
Patients admitted during the study period	2345
Patients received Cephalosporins	1710
Means "Hospital Stay"	3.81 (4.19)

The average duration of therapy was 4-5 days. The CST test was performed in 307 patients (5.34%). The average number of antibiotics per prescription was found to be 1.65 + 0.61.

3.1. Prescribed Pattern of Antibiotics

A total of 2155 Cephalosporins were prescribed among 1710 patients who met the inclusion criteria. Among Cephalosporins ceftriaxone was prescribed to 1111 patients (51.5%), cefotaxime sodium to 571 patients (26.51%), Cefepime to 244 patients (11.31%) and Ceftazidime to 229 patients (10.64%). Table. 2 defines class-wise usage of cephalosporins prescribed among pediatric in-patients.

Table 2 Usage of cephalosporins

Class	Drug	N (Percentage)
Cephalosporins 4199 (72.99%)	Ceftriaxone	1111 (51.55)
	Cefotaxime	571 (26.50)
	Cefeperazone & Sulbactum	00 (00)
	Cephradine	00 (00)
	Ceftazidime	229 (10.64)
	Cefepime	244 (11.31)
Total		1710 (100)
The Type of Therapy		
Single Antibiotic Therapy	1519 (70.5%)	
Double Antibiotic Therapy	584 (27.1%)	
Triple Antibiotic Therapy	52 (2.4%)	
Total	2155 (100%)	
Route of Administration	**Percentage**	
Parenteral	74.34	
Oral	25.66	
The Type of Therapy	**Percentage**	
Empirical	95.33%	
Targeted	4.47%	

3.2. Indication of Therapy Used

During the study time, the most common diagnosis was Pneumonia (22.8%) followed by Bronchitis (15.4%) and Urinary Tract Infection (12.4%) following other indications. The details of the indications treated with antibiotics are summarized in Table 3.

Table 3 The indication for therapy used

Diagnosis	Number	Percentage
Pneumonia	391	22.8
Diarrhea	168	9.8
Common Cold	116	6.8
Bronchitis	263	15.4

Continuation of Table 3		
Tonsillitis	106	6.2
Gastritis	138	8.1
Meningitis	24	1.4
Urinary Tract Infections	212	12.4
Sepsis	80	4.7
Enteric Fever	96	5.6
Others	116	6.8
Total	1710	100

3.3. Duration and Type of Antibiotic Therapy

The average number of antibiotics per prescription was found to be 1.32 + 0.43 days. Most of the patients (72.7%) received antibiotic therapy for up to 5 days. 15.6% of the patients were dispensed antibiotics for a period of 7 days and rest was prescribed for more than 7 days. Single antibiotic therapy was received by 70.5% of the patients, while the 27.1% patients were given a double antibiotic regimen and 2.4 % of the patients received triple antibiotic therapy respectively. The details are summarized in Table 2.

4. Discussion

This study was designed to evaluate the antibiotic usage pattern in the pediatric department of trust -based Hospital. A total of 1710 eligible children in-patients were selected as per inclusion criteria, and their therapy was examined from the Patient Bedside File (PBF) against antibiotic consumption. The mean age was 3.52 +4.10 years. Children less than 01 year to 05 years had the highest occurrence (n=795, 46.5%). Similarly, a higher proportion of antibiotics was observed at the health center among children under 5 years old (63.4%), and higher among inpatient neonates (94%) in the Gambia [14]-[15].

Among the 1710 cases who met the inclusion criteria, there were more male child patients than female child patients, (n=982, 54=57.4 %) and (n=728, 42.6%) respectively. Similar findings were reported by [9], [16]-[18], previous observations are concurrent with these findings.

This study depicts 76.20 % of the antibiotics that were administered through the parenteral route of administration, which is in very close resemblance to the study of Nigerian tertiary hospital that accounted for 80-86% parenteral route of administration [19]. In the Southern Ethiopian study, according to [20], 90.17% of injectable antibiotics were administered among the in-patient pediatrics, whilst the Palestinian study [21] found 61.8% injectable administration. The report of Bishoflu hospital, India accounted for 83.1 % of parenteral route administration [22]. However, a study conducted in Pakistan, parenteral antibiotic administration was accounted for 96% [23]. The World Health Organization (WHO) has set acceptable limits from 13.4 % to 24.1% of injectable among the total prescriptions for healthcare settings.

The prominent use of cephalosporins in the current study is in resemblance to the findings of other evaluations where cephalosporins among antibiotics (and in particular ceftriaxone) were more frequently prescribed antibiotics [24]-[25]. Uncontrolled consumption of third-generation cephalosporins could be the cause of an increase in antimicrobial resistance, especially *Escherichia coli* and *Klebsiella pneumonia.*

Third generation Cephalosporins were the most often prescribed antibiotics. According to Table 2, in the pediatric Unit, in particular Ceftriaxone (51.55%) was followed by Cefotaxime sodium (26.50%). Third generation cephalosporins have a wider range of antibacterial activity, therefore, these agents are more frequent. These findings relate to few older studies [17], [23] and [26] that accounted for cephalosporin as the most commonly prescribed antibiotic class in pediatric units.

It was revealed in the current study that most of the therapy was empirical therapy. In hospitals such as government or trust-based hospitals, the unavailability of Culture sensitivity test facility or its unaffordability, diagnosis delay, also somewhere delay in report and patient's own refusal for CST and immediate therapy are the potential reasons for empirical therapy. This complies with the findings described in [27], where most of the prescription proposed that antibiotics were released on an empirical basis. The antibiotics were prescribed without diagnosis or 50% of patients were prescribed antibiotics on suspected infections amid inpatient pediatrics. Cephalosporins are given more priority over Penicillin because of its proven more efficient antimicrobial activity and clinical efficacy than Penicillin [29]. Cephalosporin having another benefit over penicillin increased allergic reactions with penicillin.

According to [21], in 22.8 % cases, a single antibiotic was prescribed, and in 51.5% of prescription, two antibiotics were advised. In this study, 70.5 % prescriptions contained single antibiotic, whereas in 29.5 prescriptions, multiple (double and triple) antibiotics were prescribed and this was comparable to the findings of [29]-[30], where out of 29.5% of cases, 27.1% cases contained two antibiotics, and only 2.4% contained three antibiotics. In this study, the most frequent route of antibiotic administration was observed as an intravenous route (74.34%) followed by oral route (25.66%). The same findings were observed in [29].

5. Conclusions and Recommendations

This study discloses that Cephalosporins are prescribed widely in pediatrics followed by penicillin than any other class of antibiotics. This study reports that as per already published literature and data collected from Government Hospitals, this hospital also had no approved protocol/guidelines available in the hospital to follow for antibiotic prescribing. It is therefore suggested that the Government should design and implement Antibiotics Prescribing Policy for all

healthcare settings and direct the concerned hospitals to follow these guidelines and adopt an Antibiotics stewardship program to avoid the irrational use of antibiotics and save masses from Anti-Microbial Resistance, which can be fatal in most of the cases.

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