Antibiotics Utilization Pattern in a Children's Medical Center in North of Iran

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Abstract

Background: The development of a system for rational use of antimicrobials seems mandatory. Furthermore, since hospitals do not share the same bacterial flora and have different patterns of antibiotic therapy the purpose of the present study is to perform a Drug Utilization Evaluation (DUE) on the pattern of antibiotic administration in patients hospitalized in 17 Shahrivar Pediatric Hospital, RASHT, Iran.

Methods: In this descriptive cross-sectional study that was conducted in a one-year period (2021-2022), 560 patients were randomly selected and their medication data were collected based on the gender and age as well as the type, dose, duration of antibiotic therapy and the results of bacterial cultures and also susceptibility of the infectious microorganisms.

Results: The average age of patients was 53.56 months with 46.9% of them being less than 24 months old. The highest rate of antibiotics administration belonged to the infectious diseases ward (30%) and 33% of antibiotics were prescribed by pediatric infectious diseases specialists. The result of most of the cultures was reported as negative (98.38%), the most prevalent microorganism was Escherichia Coli from urine cultures (2.38%) and Staphylococcus Aureus from sputum cultures (14.28%). The highest prescribed antibiotics were ceftriaxone (51.2%) and vancomycin (45.6%). It was determined the antibiotic stipend was 15.6% of the whole budget for purchasing medicine.

Conclusion: It is necessary to develop a guideline regarding the prescription of antibiotics in children's departments, which reduces empiric treatment and the requirement to adjust the drug after a negative culture.

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Keywords: Antibiotics; Drug Utilization Evaluation; Pediatric

Introduction

Antibiotics are drugs used to defeat infectious diseases by either killing or hindering the growth of bacterial pathogens (1). Although they have benefited humans for decades, the inappropriate administration of them not only brings about several side effects, outweighing their advantage for a variety of patients, but it has also caused the serious dilemma of antibiotic resistance by causing the microorganism to mutate and become too strong to be ceased (2, 3).

Due to the extensive prescription of antibiotics in hospitals, a huge source of this issue is originated from health centers as a result of causeless use of antimicrobial agents (4). Moreover, researches have indicated approximately one-fifth of the hospitalized patients acquire hospital infections which is another cause of excessive antibiotic prescription (5, 6).

The resistant species of bacteria are difficult to conquer and they also are an important threat to the community (7, 8). Moreover, statistical analysis has indicated about 30-60 % of ICU patients and 20-50% of hospitalized patients are unnecessarily treated with antibiotics (either by a health professional or self-medication) which also results in a serious economic burden on the health system of a country (9). Based on different studies, the frequency of inappropriate inpatient antibiotic administration in Iran is the same as in other countries (10,11), but it seems that injectable antibiotics are used unnecessarily high in some pediatric diseases (12). Therefore, the development of a system for rational use of antimicrobials seems mandatory.

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Furthermore, since hospitals do not share the same bacterial flora and have different patterns of antibiotic therapy, understanding the consumption algorithm of each hospital is vital to lessen the risk of antimicrobial resistance (13). Hence, the purpose of the present study is to perform a DUE (Drug Utilization Evaluation) on the pattern of antibiotic administration in patients hospitalized in 17 Shahrivar Pediatric Hospital, RASHT, Iran.

Methods

The present study is a descriptive prospective study that was conducted in each of the wards of 17 Shahrivar Pediatric Hospital in a one-year period (2021-2022). All patients who were treated with intravenous antibiotics during this period with odd medical file numbers, randomly selected from chemotherapy, internal, infectious diseases, pediatric intensive care unit (PICU) and neonatal intensive care unit (NICU) wards and their medication data were collected and classified based on the gender and age of the admitted patients as well as the type, dose, duration of antibiotic therapy and the results of bacterial cultures and also susceptibility of the infectious microorganisms. After the identification of bacterial species and strains, microbial susceptibility tests were performed by the means of disk diffusion method. The protocol of the study was evaluated and approved by the ethical committee of Guilan University of Medical Sciences (Code: IR.GUMS.REC.1401.188).

Statistical analysis was executed by SPSS statistical package (version 24). Quantitative data were expressed as the mean ± standard error of the mean (SEM) and qualitative data were reported as frequency and percentage.

Results

560 patients' data were enrolled in this study. The present study demonstrated that male patients received 53.8% of prescribed antibiotics and the rest was administered to females. The average age of patients was 53.56 months with 46.9% of them being less than 24 months old. Of different wards of 17 Shahrivar Hospital, the highest rate of antibiotics administration belonged to the infectious diseases ward (30%) followed by internal diseases ward (21.3%), hematology-oncology ward (16.3%), and others (32.4%). 33% of antibiotics were prescribed by pediatric infectious diseases specialists, followed by pediatric hematologist-oncologists (15.6%), pediatric respiratory diseases specialists (12.5%), pediatric neurologic diseases specialists (11.3%) and others (27.6%). The most common infections were respiratory infections (43%).

An approximate number of 981 specimens were obtained from various sources of patients' bodies such as their blood, urine, stool, CSF, sputum and lymph nodes. Although the result of most of the cultures was reported as negative (98.38%), the most prevalent microorganism was Escherichia Coli from urine cultures (2.38%) and Staphylococcus Aureus from sputum cultures (14.28%). Statistical analysis of the rate of antibiotic consumption in different wards indicated the highest prescribed antibiotics were ceftriaxone, vancomycin, cefotaxime, amikacin, metronidazole, clindamycin, and ceftazidime with a percentage of 5, 1.2%, 45.6%, 27.5%, 19.4%, 16.2%, 16.2% and 12.5% of patients, respectively. Due to the negative results of most specimen cultures, the results of antibiograms are not very conclusive. The most antibiotic-resistance results were ciprofloxacin (31%), amikacin (29%), ampicillin (25%), and TMP-SMX (23%). The mean duration of antibiotic therapy was 15.3 ±3.2 days. The only observed adverse drug reactions were infusion-related hypotension (5%) and rash (2%) that were relieved with decreasing infusion rate. Ceftriaxone and vancomycin were the first antibiotic selections for Escherichia coli and Staphylococcus aureus respectively. 12 percent of administered antibiotics were under dosed and the rest were in normal weight-based dosing. No data of dosage adjustment are available.

It was determined the antibiotic stipend was 15.6% of the whole budget for purchasing medicine. The average length of hospitalization of patients was 6.21± 2.82 days.

Discussion

The lack of a strict regulation in antibiotic prescription is a tremendous issue in Iran. Therefore, the development of a precise policy is of great importance which primarily is in the need of understanding the administration patterns of antimicrobials of each hospital as a basis for further interventions. Since children are more prone to bacterial infections, we aimed to evaluate antibiotic utilization and antimicrobial resistance pattern in patients admitted to 17 Shahrivar Educational and Medical Center Children, 2020-2021.

Our results demonstrated the most common prescribed antibiotics in the one-year period were ceftriaxone, vancomycin, cefotaxime, amikacin, metronidazole, clindamycin, and ceftazidime and the highest rate of antibiotic consumption belonged to the infectious diseases ward.

A study in Valie-asr Educational Hospital conducted by Nobarani et al., indicated the infectious ward had also

the highest rate of antibiotic prescription (27% of total) as compared with other wards of the hospital which is consistent with our data (14). Moreover, in another similar research in Bou-Ali Hospital of Tehran, the aforementioned ward had also the maximum usage of antimicrobials (15). However, there is a literature showing different results in Sari, Iran which reported the oncology ward of a hospital consumed the highest rate of antibiotics which was followed by the ICU ranking second (16).

The average duration of hospitalization was 6.21±2.82 days in our study. Khakshour et al., showed antibiotic administration in children diagnosed with gastroenteritis not only did not reduce days spent in the hospital, but it also was a reason to increase the admission period which results in excessive costs and puts the child and his family in a stressful situation along with the increased risk of acquiring hospital infections (17).

In another study in USA, two groups of patients were compared based on whether the received antibiotic was broad-spectrum or not. The results of this study represented there was no significant difference in hospitalization period nor ICU admission and re-hospitalization after discharge between the two groups (18).

Our investigation demonstrated the most prevalent microorganism in urine cultures of patients was E. coli which is compatible with the results of another study in 2013 performed by Aghamahdi et al., in 17 Shahrivar hospital which aimed to identify antibiotic resistance pattern in patients with a diagnosis of UTI in this centre. He reported that in the 77 patients of his study, 59.7% had a positive culture of E. coli which was resistant to ampicillin (94.1%), amoxicillin (88.9%), cefalexin (70.5%), cotrimoxazole (66.7%) and cefixime (75%) (19).

Based on our findings, in 5.6% of patients, there was a change in antibiotic regimen based on antibiogram and cultures, and in other cases, empiric antibiotic therapy was continued. In a study by Khoshdel et al., in 2012 in the pediatric ward of Hajar Hospital in Shahr-e-Kord, Iran, 89.9% of the examined patients were prescribed in an empirical manner and only 10.1% had a modified antimicrobial diet after their laboratory reports came back negative (20) whereas in a study in Switzerland, only 19% of patients received empirical antibiotic regimens (21).

It is noteworthy to mention among all antimicrobials, ceftriaxone had the most frequent prescription rate, leading to an increasing resistance in various strains of microorganisms which is confirmed by multiple studies in Iran. For example, Gholami et al., announced ceftriaxone was the most prevalent antibiotic utilized in the emergency ward of a hospital in Tehran, Iran with a rate of 72.1% (22). Apart from the surging incidence of resistance to this medicine, third generation of cephalosporins are of a considerable price as compared with other agents hence it is of great importance to rationally prescribe them.

Although there are various factors which determine the differences between antibiotic consumption patterns, it seems the regulatory policy for administration of third generation cephalosporins has played a key role in determining antimicrobial resistance pattern in European hospitals as compared to Iranian ones.

We also concluded the stipend of antimicrobials was 15.6% of the whole budget dedicated to medicine in 17 Shahrivar Hospital in 2021-2022 which is an acceptable amount compared to other national health centers (20%-50% of total medicine financial plan) (15, 23).

Statistical analysis manifests during the past few years, antimicrobial agents were drastically consumed in our country (24). Therefore, there is a pressing need to rationalize the prescription and consumption of antibiotics to not only overcome antimicrobial resistance, but also lessen the economic burden on both people and the government.

In the current situation, when the world is facing a shortage of new antibacterial drugs, and on the other hand, the rate of spread of antibiotic-resistant bacterial species is increasing, the need for rational use of antibiotics is becoming more apparent.

In this regard, it is necessary to develop a guideline regarding the prescription of antibiotics in children's departments, which reduces empiric treatment and the requirement to adjust the drug after a negative culture and, in parallel, to develop microbial culture methods with more reliable results.

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