REVIEW ARTICLE

Misuse of Antibiotics in Pediatric Patients – A Comprehensive Review

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ABSTRACT

To identify and assess the likely causes of antibiotic overuse in the Pediatric outpatient department (OPD) of a busy teaching hospital. Overuse of antibiotics has emerged as a significant global pediatric concern. Specifically, the sale of drugs without a prescription from a doctor and other circumstances may have an impact on the abuse of antibiotics. Antibiotic resistance is encouraged by the misuse of antibiotics, particularly when antibiotics are used, even when they are not the recommended course of therapy. The Centers for Disease Control and Prevention estimate that between one-third and half of all antibiotic usage in humans is unwarranted or improper. Viral pathogens are the primary cause of respiratory tract infections (RTI) in children compared to adults. Interestingly, compared to adults with RTI, very little is known regarding the usage of antibiotics in children.

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INTRODUCTION

Since their original discovery in the 1940s, antibiotics have been heralded as miraculous medications. As if to emphasize the point, indiscriminate usage happens to variable degrees in practically every aspect of medical practice around the globe. Its usage boosts patients' and doctors' confidence in equal measure, which can result in abuse or overuse. Pharmaceutical firms' marketing touting the amazing benefits of these miracle treatments also contributes to this. Numerous instances of this type of situation include viral infections for which broad-spectrum medicines are frequently provided in place of more targeted ones. Broad-spectrum antibiotics instead of the narrower spectrum. The issue is especially severe in underdeveloped nations where antibiotics are widely accessible as over-the-counter medications. Due to improper usage, the occurrence of nosocomial infections and bacterial resistance has alarmingly increased. This has led to the introduction of higher-generation medications into the pharmaceutical market, which come with a larger price tag and undesirable side effects.[1] Ever since the second half of the 20th century was documented, antimicrobial medicines have served as the cornerstone of clinical care and have prevented countless children from contracting potentially fatal bacterial illnesses.[2] The most significant disagreement about hospitalized patients' health is due to antibiotic-associated disorders (ARPs). A sizable portion of the populace in emerging nations is made up of children and infants.[3] The primary reason why resistance develops is the improper usage of antimicrobial drugs. For this reason, it's critical to incorporate outpatient clinics in the creation of antibiotic stewardship initiatives. Antibiotics have been used to save lives since their discovery decades ago, and they currently account for a significant portion of drug-related medical costs. They were responsible for the elimination of several dangerous bacterial diseases, especially in children. Children do, in fact, ingest a significant amount of antibiotics; research indicates that children between the ages of one and five years use 65% more antibiotics than teens (38%). Antibiotic use, in both adults and children, hasn't always been sensible or appropriate, and mistakes can occur with antibiotic indications, selection, dosage, administration, or even medication adherence. Therefore, "antibiotic misuse," which is defined as the excessive or illogical use of antibiotics, might endanger patients of all ages and include any kind of antibiotic.[4]

Over-prescriptions

Whether or whether clinical indicators support the prescription of antibiotics to a pediatric child, the choice to do so is the result of a complicated interaction between the doctor, the patient, and their respective caregivers. The prevalent diagnostic strategy in the setting of EDs frequently prioritizes quick decisions and gut feeling above thorough assessments.

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Qualitative studies conducted in this field have revealed a range of cognitive biases that significantly impact judgments on antibiotic treatment. Childhood illnesses cause discomfort in children and concern in caregivers, especially when they are accompanied by fever and respiratory problems.[5] As a result, they typically require immediate medical intervention. External variables may amplify this sense of urgency, such as the need to be seen as responsible guardians by loved ones and daycare providers. Prescriptions for antibiotics need to be written correctly for several reasons. First and foremost, rashes, nausea, diarrhea, and stomach discomfort are just a few of the unwanted side effects of utilizing antibiotics. Even though they are uncommon, more serious adverse effects include skin blistering, anaphylaxis, and kidney damage.[6]

Distribution of antibiotic in paediatrics

The prescribing practices, as revealed by pediatric antibiotic usage, is quite telling, and this is mostly due to the nature of infections that can be found in pediatrics. According to one study, cephalosporins are the most prescribed antibiotics, 45% of prescriptions, penicillins, 27% and macrolides, 7%. The most common conditions treated are respiratory infections, which account for 37% of cases, and this is consistent with the large use of these classes of antibiotics. It also underscores the need for appropriate antibiotic stewardship, as overprescribing continues to be a problem, especially in pediatric intensive care units, where dosing is frequently based on extrapolated adult data. Also, there is a large variation in the total antibiotic usage in children's hospitals, with the usage being much greater in specialized units like oncology and the ICU's, but this is usually do to the seriousness of infections and the necessity of prophylactic treatments. This marks the importance of continued surveillance and improvement of antibiotic usage to overcome resistance and provide adequate therapy in the pediatric population. The distribution of antibiotic usage is as shown in Table 1.

Consequences of Antibiotic in Pediatrics

Effects on individuals

Every prescription has side effects, even the safest ones. Adverse drug responses encompass idiosyncratic reactions, drug toxicity, delayed (non-Ige mediated) allergic reactions, intolerance, and rapid (Ige mediated) allergic reactions. The gastrointestinal or dermatological systems are the most often seen sites of adverse medication responses in children.

Table 1: Distribution of antibiotic usage

Antibiotics	*N*
Cephalosporins	1. 224
Penicillin	2. 133
Glycopeptides	3. 21
Aminoglycosides	4. 15
Quinolones	5. 6
Macrolides	6. 36
Carboxylic acid	7. 2

Depending on the medication, up to 25% of people who are exposed to them may get antibiotic-associated diarrhea. Around 25% of people get diarrhoea.[6]

The implications of antibiotic overuse on society

Antibiotic misuse has major detrimental effects on individuals, but it also has growing negative effects on society, chiefly in the form of antimicrobial resistance (AMR). Since the discovery of the first antibiotic, mechanisms behind resistance to antimicrobial drugs have been understood. Sulphonamides were the first class of antibiotics to be approved for therapeutic use in 1937. A few years later, bacterial strains resistant to sulphonamides were identified.

Risks associated with antibiotic resistance in pediatric ambulatory care

Malaria that is resistant to drugs, both extensively and multidrug-resistant (MDR/XDR). The two most dangerous worldwide threats linked to antibiotic resistance are tuberculosis and HIV resistance, according to the World Health Organization. Although these illnesses are becoming more widespread and pose a serious risk to morbidity and death in developing nations, pediatric ambulatory primary care facilities in the United States do not frequently encounter these disorders.[6]

Quick antigen identification exam

Despite the fact that viruses are known to be the primary cause of respiratory tract infections (RTIs), Children with RTIs are often administered antibiotics. Therefore, point-of-care rapid viral testing for a range of respiratory viruses, with results available in 40 to 70 minutes, may decrease the number of antibiotic prescriptions if treatment is not given in the event of a positive test result. Studies conducted on adult populations in the past have discovered a link between the usage of quick antigen detection tests and a decline in the prescription of antibiotics among patients seen in emergency departments. Furthermore, early research using respiratory panel or fast influenza testing has suggested that children may have comparable results. Better-designed recent pediatric studies, however, were unable to demonstrate that children's prescriptions for antibiotics were decreased as a result of quick antigen detection tests.[7]

The symptoms of bacterial and viral illnesses frequently overlap, it can be challenging.

Differentiate between them in pediatric therapy

- *Viral infection*

Common signs of viral infections, such as upper respiratory infections, include sore throats, low-grade fevers, runny noses, coughs, and trouble sleeping. Antibiotics and antiviral medications do not speed up the healing of colds. High fever and severe body aches are typical signs of influenza, a virus that can produce many of the same symptoms. Unlike upper respiratory illnesses, antiviral medications can shorten the duration of the flu as long as the illness is detected within the first 48 hours of symptoms.

Getting vaccinated against influenza can aid in the prevention of influenza infections at the beginning of each "flu season".[8]

- *Bacterial infection*

Occasionally, we start to worry that the sickness may be anything except a bacterial infection. The following circumstances might lead to a "secondary infection" (i.e., the virus started the process, but a bacterium followed). The symptoms are more persistent than anticipated. A typical virus might last between 10 and 14 days. The fever doesn't go down after a few days of illness; rather, it becomes worse.[8]

DISCUSSION

Parents Outcomes

Parents still don't understand the full spectrum of effects that antibiotics can cause. Of them, 42% had no idea that they were used to treat illnesses caused by bacteria. The findings align with a different survey conducted in India, where more than 45.9% of parents believed that antibiotics may be used to treat bacterial and viral illnesses. The fact that doctors usually refer to "germs" rather than particular bacteria when prescribing antibiotics during counseling may help to explain this. Resounds et al. claim that people often assume that medications are effective against both viruses and bacteria because they are unaware of the differences between the two. According to a recent study, community pharmacists' staffing levels and budgetary situations also prevent them from having enough time for patient counseling. Moreover, the entire range of side effects that antibiotics might have is yet unknown to parents. Of them, 42% did not know that they were used to treat bacterial diseases. The results are consistent with a separate poll that was carried out in India, wherein over 45.9% of parents thought that antibiotics might be used to treat viral and bacterial infections. This may help to explain why, when prescribing antibiotics during counseling, doctors typically refer to "germs" rather than specific bacteria. People frequently believe that drugs work against both bacteria and viruses because they don't know the distinctions between the two, according to Resounds et al. A recent study found that the budgetary constraints and staffing levels of community pharmacists also impede their ability to have adequate time.

According to the results, 52% of pharmacists thought that low doses were a major contributor to antibiotic resistance, whereas 37.1% thought that longer treatment periods were more crucial than shorter ones. What is true for the dose is not true for the length of the therapy, even if the long treatment duration (10 days or more) has a greater detrimental effect by exposing bacteria to antibiotics for longer periods of time and so increasing the survival of more resistant bacteria. Lower dosages promote the growth of low-resistant bacteria and raise the likelihood that they may develop resistance.[9]

Medication and Patients

The main goal was to examine the trends and justifications for antibiotic usage in pediatric patients ranging in age from one month to fifteen years. The assessment of primary care physicians' prescribing practices in pediatric outpatient departments, together with the likely rationales for such practices, and the evaluation of parents' and guardians' understanding of the treatment received and the usage of antibiotics were the secondary objectives. The Hospital Ethics Committee granted approval for the project. The following factors were taken into consideration while evaluating the logic of antibiotic use: (1) indication of antibiotic therapy, (2) antibiotic selection, (3) dose, and (4) therapy duration. The trial did not include any particular chemotherapeutic agents, such as antimalarials or antitubercular medications. Combination medications, such as norfloxacin and metronidazole, were prescribed as a single antibiotic. With their informed agreement, the parents/guardians were questioned about their social background, their understanding of the illnesses for which they were receiving treatment, and their opinions concerning the use of antibiotics. A pre-made questionnaire was used for this purpose. The first author took notes on the responses and then repeated them to get their approval.

The Childhood Origins of Antibiotic Resistance

Antibiotics are prescribed to children more frequently than any other kind of medication because they are more likely to contract infections of different origins, ranging from the less common meningitis to the more common UTI.[10]

Childhood Hospitalized Antibiotic Overuse and Misuse

The misuse of antibiotics is the main cause of the present surge in antibiotic resistance. The main factor contributing to antibiotic abuse is a lack of knowledge about the pharmacokinetic and pharmacodynamic characteristics of the different antibiotic classes and the bacteria associated with different illnesses. Posology, medication selection, dose accuracy, and length of treatment course are all significantly impacted by these factors. Moreover, especially in outpatient therapy, antibiotics are still often used for false diagnoses of viral illnesses.[11,12]

Posology and Dosage Compatibility in Pediatrics

Pharmacological therapy should be prescribed to pediatric patients based on appropriate criteria such as prescription, safety, posology, and efficacy profiles. Taking into account the considerable variation in pediatric pharmacokinetic variability which is partly age-dependent this is especially true. Due to the lack of clinical trials specifically designed for children using antibiotics and the common practice of extrapolating adult pharmacokinetic and pharmacodynamic data to the pediatric population, there are few high-level evidence-based resources and only pediatric guidelines available. Even if it is helpful to extrapolate pharmaceutical efficacy data to the pediatric population, dose-finding and safety pediatric studies are still necessary to give the best level of treatment to this important group. Extrapolation as a practice and a dearth of pediatric-specific clinical studies on antibiotics frequently result in antibiotic abuse, over- or under-dosage, and/or the emergence of pediatric-specific antibiotic-resistant bacterial strains.

Two Current Risk Factors for Infection

The bacteria in biofilms stick to the injured tissue or implanted medical device, which is why they are linked to recurrent infections that are resistant to antibiotic treatment. In biofilms, bacteria do not need aggressive virulence to thrive; instead, they rely on a tenacious survival strategy. Even while biofilm infections are seldom lethal, they can persist for months or even years and are frequently resistant to medicine.

It is difficult to treat biofilm-induced infections because they need large doses of antibiotics to be taken for extended periods of time. It appears that the defensive mechanisms of bacteria in biofilms are unrelated to the recognized processes of antimicrobial resistance, which include altered enzymes, target mutations, and efflux pumps. It appears that the unique environment this cell film forms may give an innate resistance to antibiotics, as antibiotic sensitivity is actually a typical characteristic among bacteria that are released from the biofilm. Three main ideas might account for the bulk of antibiotic-resistant biofilm infections, as standard antibiotic resistance mechanisms cannot fully explain these cases. The first theory posits that there is a possibility that the antibiotic will enter the biofilm slowly or incompletely. The second theory holds that the biofilm's chemical microenvironment will change, and the third theory posits that a subpopulation of bacteria within the biofilm will change into "persisted cells," a distinct and highly protected phenotypic state.[13,14]

CONCLUSION

PEM continues to see a lot of antibiotic overprescribing, which is exacerbated by demand on EDs throughout the globe, patients' and caregivers' felt pressure, diagnostic ambiguity, and prescribers' decision fatigue. Finally, it should be noted that antibiotic abuse is a major global public health issue. Physicians must be conscious of the gaps in their knowledge and the potential for incorrect administration techniques among child caretakers. In this sense, corrective actions can lower the likelihood of prescription mistakes. The majority of parents acknowledged giving themselves antibiotics. They don't have as much of an impact as we thought on the overuse and purchase of antibiotics over the counter. Parents are also aware that using antibiotics unnecessarily can be hazardous and that the majority of upper respiratory tract illnesses have a benign course. Intervention is required to raise awareness about the prudent use of antibiotics and to prevent the unapproved distribution of antibiotics. Physician education should incorporate techniques for sensible antibiotic prescription and excellent patient communication to guarantee patients follow advice and, as a result, decrease self-medication. Examining and summarizing the effects of antibiotics on children under five's physical and physiological development was the goal of the scoping review. Investigating and compiling data on antibiotics' impact on children under five years old's physiological development was the aim of the scoping review. The examined literature makes it abundantly evident that parental behaviors, attitudes, and understanding of the use of antibiotics have a major impact on how children's diseases are managed.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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