Research Article

Antibiotic usage pattern among inpatients of a paediatric ward in a tertiary care hospital in Eastern India

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ABSTRACT

Background: The inevitable consequence of the widespread use of antimicrobial agents has been the emergence of antibiotic resistant pathogens. The rising incidence of bacterial resistance to common antibiotics, particularly, multi-drug resistant pneumococci, has prompted the need to use antibiotics judiciously in paediatric practice. The present study thus attempted to understand the antibiotic usage pattern among inpatients in a paediatric ward of a tertiary care hospital.
Methods: A cross-sectional study was carried out for three months among the inpatients in the Department of Pediatrics in a tertiary care teaching hospital, Kolkata. The data regarding patient's demographics and antibiotic use was collected daily in a pre-structured proforma. A descriptive statistical analysis of the data was performed.
Results: A total of 124 patients were screened of which males and females represented 58.06% and 41.94% of the cases respectively with age group of 2-14 years presenting in majority. Among various causes of hospitalization, prevalence of respiratory disorders were maximum (25.81%), followed by hematological disorders (25%). Among various categories of prescribed drugs, antibiotics were found to be maximum (39.25%). Beta-lactum antibiotics were prescribed in majority (64.41%) with 56.91% being of cephalosporin group. The preferred route of administration was found to be parenteral (64%). 61.29 % cases were ordered laboratory investigations prior to the antimicrobial therapy initiation. About 63.16% of the total samples for culture & sensitivity tested were reported positive. 39.58% of these positive cases showed resistance to empirical antibiotic therapy on lab reports.
Conclusions: The study enables to obtain information on the antibiotic usage pattern in the pediatric population, focusing on prevalence of antibiotic misuse in our set-up and suggesting strategies of its minimization.

Keywords: Antibiotic usage, Antibiotic misuse, Empirical therapy, Pediatric population

INTRODUCTION

Infants and children are among the most vulnerable groups that contract illnesses. The use of antimicrobial agents has become a routine practice for the treatment of paediatric illnesses and antibiotics are among the most commonly prescribed drugs in this population.[1] Antibiotics are one of the most significant therapeutic reserves of the medical history. However, the inevitable consequence of the widespread use of antimicrobial agents has been the emergence of antibiotic resistant pathogens.[2] Paediatricians and other medical personnel

who provide health care for infants and children in developing countries are faced with numerous challenges due to the shortage of appropriate drugs, costs and lack of infrastructure.[3] The rising incidence of bacterial resistance to commonly used antibiotics has made judicious use of antibiotics in pediatric practice a mandate.[1] It has been reported that 20-50% of antimicrobial usage is questionable or inappropriate.[4]

Excessive and inappropriate use of antibiotics in hospitals, health care facilities and the community contributes to the development of bacterial resistance. Proper information about antibiotic usage pattern is thus an absolute necessity for a constructive approach to the problems arising due to inappropriate use of antibiotics especially among the pediatric population.

Proper selection of antibiotics is a multifaceted process that required careful clinical judgment. Its medical, social and economic aspects are well reflected in the WHO definition which states "Rational use of drugs requires that patients receive medications appropriate to their clinical needs, in doses that meet their own individual requirements for an adequate period of time, at the lowest cost to them and their community".[5] Irrational use of drugs is common in developing countries with a high rate of polypharmacy, overuse of antibiotics and injections, use of 'off-label' drugs and drugs with improper efficacy.

Understanding the problem of antimicrobial resistance in a hospital cannot be achieved without the knowledge of the hospital's pattern of antimicrobial use. Research to date has focused mainly on adult populations, but there is still dearth of information on the antibiotic prescribing practices in paediatrics.[6-9] The present study was thus planned to monitor and assess the antibiotic prescribing pattern among inpatients admitted in a tertiary care hospital in eastern India.

METHODS

A cross-sectional observational study was carried out in the Inpatient Department of Pediatric in a tertiary care teaching hospital, Kolkata for three months (April – June 2014). Institutional ethics committee approval was taken prior to start the study. Written informed consent was obtained from all parents/ legally acceptable representatives (LARs) and additional assent was obtained from subjects more than 7 yrs of age. The data from case records of patients from the paediatric ward during the study period were taken up for analysis. The demographic details of the patients were recorded. The date of admission and discharge, along with the diagnosis written in discharge summary was duly noted. Particulars like name, dose, frequency, duration and route of administration and number of drugs prescribed per admission were documented.

Inclusion criteria

1. Subjects of either sex less than 7 yrs who are admitted in pediatric ward of a tertiary care teaching hospital, Kolkata and parents is/are willing to give consent.
2. Subjects of either sexes more than 7 years willing to give assent and parents is/are willing to give consent.

Exclusion criteria

1. Subjects/ parents not agreeing to participate.
2. Suffering from any serious disease such as unstable coronary heart disease, heart failure, advanced kidney or liver failure.
3. Any condition resulting in severe learning disability (e.g. brain injury)
4. Those unable to comprehend for other reasons will be excluded from the study.

RESULTS

A total of 124 patients were screened for the study, of which males represented 58.06% (n=72) of the study population while females represented 41.94% (n=52). The age group ranging from 2 years to 14 years presented with majority of the hospitalization cases in our in-patient department (Table 1).

Table 1: Demographic characteristics of the study participants.

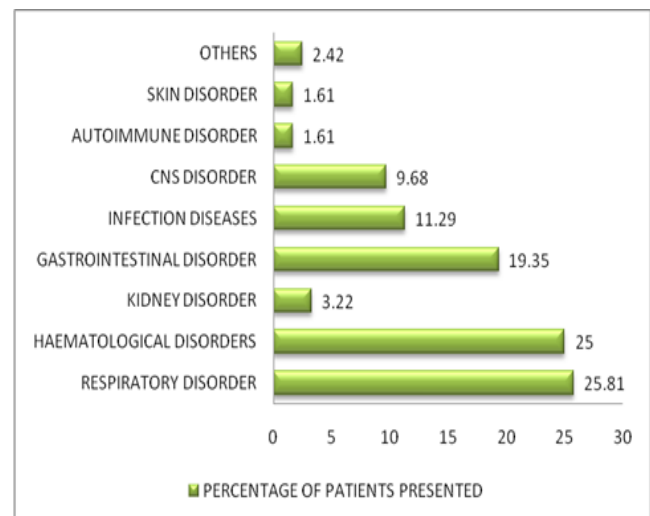| Age Group	No. of Males (%)	No. of Females (%)	Total (%)
<12 months	6 (4.84)	5 (4.03)	11 (8.87)
12-24 months	16 (12.9)	9 (7.26)	25 (20.16)
2- 14 years	47 (37.9)	36 (29.03)	83 (66.94)
14- 18 years	3 (2.42)	2 (1.61)	5 (4.03)
	72 (58.06)	52 (41.94)	124 (100)

Figure 1: Diagnosis profile of the study population (n=124).

Among the various causes of hospitalization, prevalence of respiratory disorders were maximum (25.81%), followed by hematological disorders (25%) (Figure 1).

Drug use pattern among 124 study participants was studied and analyzed. Among various categories of prescribed drugs, antibiotics were found to be maximum (39.25%) followed by analgesics (10.61%) (Table 2).

Table 2: Drug use pattern among the study population (n=124).

Drugs	Patients Receiving N (%)
Antibiotics	281 (39.25)
Anti-allergic drugs	50 (6.98)
Anti-asthma drugs	24 (3.35)
Analgesics	76 (10.61)
Anti-anxiety drugs	9 (1.26)
Anti-epileptic drugs	19 (2.65)
Gastrointestinal drugs	106 (14.8)
Cardiovascular drugs	24 (3.35)
Anti cancer drugs	10 (1.4)
Blood products	32 (4.47)
Vitamins and other supplements	51 (7.12)
Others	34 (4.75)

Spectrum of antibiotic usage pattern was assessed among the study subjects. Among the various classes of antibiotics prescribed, beta lactam antibiotics were found to be the majority being 64.41% (n=181) of the total antibiotics prescribed. This was followed by aminoglycosides (14.95%) and subsequently by glycopeptide antibiotics (6.41%), fluoroquinolones (4.98%), cotrimoxazole (4.98%) and others (Table 3). Antibiotic usage pattern for various diagnoses was also duly analyzed (Table 4).

Table 3: Spectrum of antibiotic usage among the study population (n=124).

Class of Antibiotics	Patients Receiving N(%)
Beta Lactam Antibiotics	181 (64.41)
Cotrimoxazole	14 (4.98)
Aminoglycosides	42 (14.95)
Macrolide Antibiotics	4 (1.42)
Glycopeptide Antibiotics	18 (6.41)
Oxazolidinones	1 (0.36)
Fluroquinolones	14 (4.98)
Polyene Antibiotics	7 (2.49)
	281 (100)

Table 4: Spectrum of antibiotic usage for various diagnoses.

	Beta Lactam	Cotrimoxazole	Aminoglycosides	Macrolide Antibiotics	Glycopeptide Antibiotics	Oxazolidinones	Fluroquinolones	Polyene antibiotics
Respiratory Disorder	37	15	13	0	13	0	10	0
Haematological Disorders	34	0	23	0	21	0	20	16
Kidney Disorder	4	0	0	0	0	0	0	0
Gastrointestinal Disorder	24	0	0	0	0	0	0	0
Infection Diseases	14	0	11	0	11	0	0	0
CNS Disorder	5	0	0	0	0	0	0	0
Autoimmune Disorder	2	0	0	0	0	0	0	0
Skin Disorder	3	0	3	0	2	1	1	0
Others	1	0	0	0	0	0	0	0

Table 5: Usage Pattern of Cephalosporins.

Drug	No.of Patients Prescribed	Percentage
Cefuroxime	1	0.97
Ceftriaxone	71	68.93
Cefotaxime	7	6.8
Ceftazidime	14	13.59
Cefepime	10	9.71
	103	100

The preferred route of administration was parenteral (64%) followed by 27% oral (Figure 3).

Out of 181 beta lactams prescribed, 56.91% (n= 103) were cephalosporins followed by 40.33% (n= 73) penicillin. (Figure 2) Cefuroxime, Ceftriaxone, Cefotaxime, Ceftazidime and Cefepime were found to be commonly prescribed cephalosporins, with ceftriaxone

being most commonly prescribed among these (56.91%) (Table 5).

Among 124 patients screened for the study, 76 cases (61.29%) were ordered proper laboratory investigations prior initiation of treatment. Specimens were collected for culture to identify pathogenic organisms. 63% (n=48) cases showed positive results on investigation. Out of these 48 cases, 29 cases (60%) showed resistance to empirical antibiotic therapy (Figure 4).
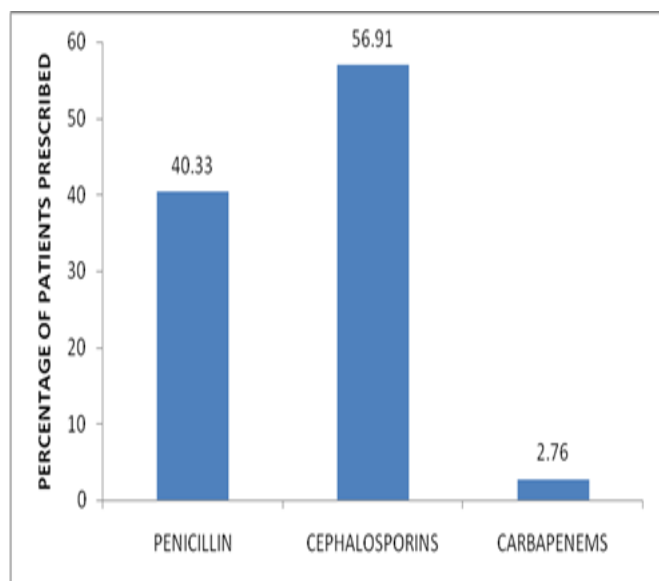

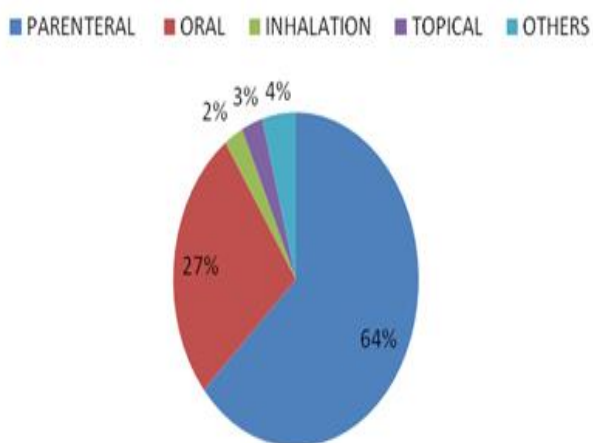**Figure 2: Spectrum of Beta lactam Usage among inpatients of Paediatric ward (N=124).**

Figure 3: Routes of administration for various drugs.

DISCUSSION

Excessive and inappropriate use of antibiotics has been a major contributor to the emerging problem of antibiotic resistance. Infants and children, being the most vulnerable groups are largely prone to be a victim of irrational

antibiotic usage practice. The present study was thus planned to monitor and assess the antibiotic prescribing pattern among inpatients admitted in a tertiary care hospital in eastern India.
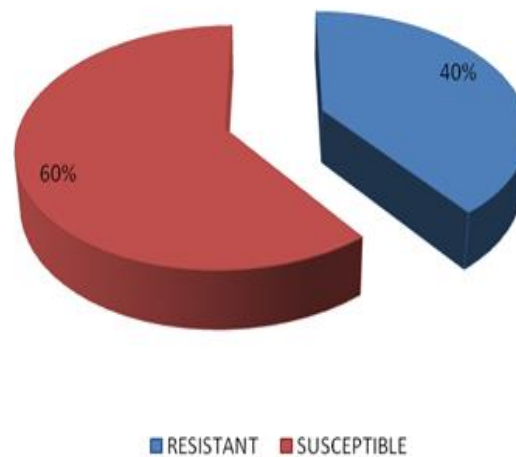

Figure 4: Spectrum of resistance to empirical antibiotic therapy.

Among 124 patients screened for the study, males represented majority of the study population in comparison to females. The age group ranging from 2 years to 14 years presented with majority of the hospitalization cases in our in-patient department.

Drug use pattern among 124 study participants was studied and analyzed. Among various pharmacological groups, antibiotics were most frequently prescribed followed by analgesics. Evidence indicates that overuse of anti-infectives is scientifically unjustified, uneconomical and gluttonous.[13] Various causes of hospital admissions were assessed among the pediatric population. Study revealed that the major cause of hospitalization was respiratory disorders which were mostly upper respiratory tract infections. Since the most common diagnosis was upper respiratory infections which could also be a viral origin thus antibiotic use in most of the cases may not be required and this can potentially lead to antimicrobial resistance which is probable to cause collapse of treatment, prolonged infection, prolonged hospital stay and increased mortality. Bacterial resistance is affecting every country of the world to some extent,[14] facilitating the rise in financial burden of the patients. Microorganisms particularly, multi - drug resistant pneumococci is an emerging threat to paediatric population, emphasizing the need of optimal selection of antibiotics.[15]

A total of 716 drugs were prescribed with the average of 5.77 drugs per patient. This finding was in contrast to previous studies.[16,17] Such high prevalence of polypharmacy can be attributed to a possible diagnostic uncertainty. This leads to increased risk of adverse

effects, drug-interactions, increased cost of therapy and reduced patient compliance.

Spectrum of antibiotic usage pattern was assessed among the study subjects. Among the various classes of antibiotics prescribed, beta lactam antibiotics were found to be the majority followed by aminoglycosides, glycopeptide antibiotics, fluoroquinolones, cotrimoxazole and others. Out of 181 beta lactams prescribed, cephalosporins were found to be the most frequently prescribed category followed by penicillin. Cefuroxime, Ceftriaxone, Cefotaxime, Ceftazidime and Cefepime were found to be commonly prescribed cephalosporins, with ceftriaxone being most commonly prescribed among them.

The use of fluoroquinolones by 14 percent of total antibiotics brings to the fact that although concerns remain regarding the adverse musculoskeletal effects of fluoroquinolones in children, their use in the pediatric population has increased in many circumstances. Pediatricians should be aware of the indications and adverse effects of fluoroquinolones. In addition, fluoroquinolones may be particularly helpful in treating multidrug-resistant infections that have not responded to standard antibiotic therapy in immuno-compromised patients. Ciprofloxacin, as one of the frequently prescribed fluoroquinolones, deserves continued monitoring. Moreover, a habit of recording adverse drug reaction must be also encouraged at all level of health care institution.

The excessive use of injectable is common in many developing countries. In this study 64% of antibiotics were given by injection. It seems necessary for the paediatric patient to be treated by of administration but consideration should be taken care for the syringes used to administer different antibiotics to the children.

When treating infections, healthcare providers realize the importance of initiating antibiotic therapy as soon as possible. It is also recognized that tailoring pharmacologic therapy to the organism(s) responsible for the infection is equally important. When initiating therapy, standard of care calls for the use of broad-spectrum antibiotics to cover the organisms usually associated with the infection being treated. Therapy is streamlined after cultures and sensitivities are available. Delaying therapy when infectious processes are suspected is not an option, but similarly, obtaining adequate cultures before administering antibiotics is equally important. In these situations, timing is a key. Obtaining appropriate cultures before initiating antimicrobial therapy plays an important role in patient care.[18] Our study revealed that only 61.29% were ordered proper laboratory investigations prior initiation of treatment. Specimens were collected for culture to identify pathogenic organisms out of which 63% showed positive results on investigation. Out of these positive cases, 60% showed resistance to empirical antibiotic therapy.

The foremost challenges in prescription of antibiotics are thus to achieve a rational choice and appropriate use of antibiotics and to recognize their potential problems. Physicians must also keep a clear understanding of need for microbiological diagnosis, use of antibiotics and make good judgment in clinical situations.

Limitations of present study and implications

Our study had certain limitations. It was a small sample sized cross sectional study. Being a government set up, no other detailed investigations could be ordered apart from routine laboratory investigations and hematological tests. Moreover the study was conducted only for a short period at a single centre with a small sample size. Thus the results cannot be a representative of national data. Further studies should try to overcome these limitations. Antibiotic policy in these government tertiary care set-ups also depends upon the availability of drugs from the government supply. As majority of the patients belonged to the low socio economic strata who couldn't afford to buy the medicines, they had to depend upon the hospital supplied antibiotics which might have influenced the pattern of antibiotics use.

CONCLUSION

Our study revealed that antibiotics were most frequently prescribed followed by analgesics. Among the various classes of antibiotics prescribed, beta lactam antibiotics were found to be the majority followed by aminoglycosides, glycopeptide antibiotics, fluoroquinolones, cotrimoxazole and others. Out of all beta lactams prescribed, cephalosporins were found to be the most frequently prescribed category followed by penicillin. High prevalence of polypharmacy was observed. The excessive use of injectable is common in many developing countries. Our study revealed that proper laboratory investigations were not ordered for all patients, prior initiation of treatment. Out of the positive cases, majority showed resistance to empirical antibiotic therapy. Minimizing inappropriate antibiotic use is thus the best way to control resistance. Monitoring and control of antibiotic use is of growing concern and strict antibiotic policies are warranted. Furthermore, hospitals should implement uniform antibiotic prescription policies based on antibiotic sensitivity pattern.

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