



Original Research Article

An Observational Study of Antimicrobials Use and Adverse Drug Reactions to Antimicrobials in Pediatric Ward of a Tertiary Care Hospital in West Bengal

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Abstract

Objectives: *In present day practice, the antimicrobials are the most frequently used medications in any hospital setting. Though they are life-saving in an infective disease background, if selected appropriately, but are not devoid of side effects. We conducted an observational study on children admitted to a teaching hospital in Eastern India, to document the range of antimicrobials being used as well as to detect any suspected adverse drug reactions (ADRs) attributable to them.*

Methods: *Hospitalized children of either sex, aged from 1 month to 12 years were studied. Data included - baseline demographic, socio-economic and clinical features, duration of hospital stay, Paediatric Intensive Care Unit (PICU) admission, antimicrobials received in hospital along with their dosing and indications and details of suspected ADRs attributable to them. The latter data were taken using the ADR-reporting form of the National Pharmacovigilance Programme of India. Causality assessment was done by using the World Health Organization - Uppsala Monitoring Centre criteria.*

Results: *Over the three months of the study 102 admissions were screened, of which approximately 34.39% were females. The median age of the patients was 5 years. Ceftriaxone and amikacin and co-amoxiclav were the principal antibacterials used. The initial choice was often empirical and occasionally included cefotaxime and cefpodoxime. Vancomycin, piperacillin-tazobactam and acyclovir were used in children requiring PICU admission. The most commonly encountered ADRs were rashes, related to vancomycin; and diarrhoea, related to ceftriaxone and co-amoxiclav.*

Conclusions: *In our setting, a limited range of antimicrobials are being used. Antibacterials are frequently started empirically, and changed subsequently, in some cases, depending on clinical parameters and culture-sensitivity reports. ADRs to antimicrobials are common and usually mild, serious ADRs were not encountered.*

Keywords: *antimicrobial, ADRs, drug rash, maculopapular, diarrhoea, raised creatinine, ceftriaxone, vancomycin.*

Introduction

The use of antimicrobials is frequent in hospital settings, especially in tertiary care hospitals. The nature and pattern of antimicrobial use changes with time as the spectrum of pathogens encountered change and as new antimicrobials are introduced. Presently about 80% of antibiotics are used in the community and the rest are used in hospitals^{1,2}. While in an appropriate setting of infective background the antimicrobials are lifesaving; on the other side, a wrongly selected agent may lead to several untoward effects. In one study³ it is estimated that 20-50% of all antibiotics use is inappropriate, resulting in an increased risk of side effects, higher costs, prolong hospital stay and higher rates of antimicrobial resistance (AMR) in community pathogens, most importantly being the methicillin resistance strains of *Staphylococcus aureus* (MRSA). Antimicrobials are known to account for a relatively large proportion of adverse drug reactions (ADRs). Literature suggests antibiotics to be the most common drug group involved in ADRs in children (about 67%), with skin and gastrointestinal reactions being the commonest, followed by several other hypersensitivity reactions, raised creatinine, transient elevation of liver enzymes and myelosuppression⁴. Antibiotic exposure has already been shown to alter the gut microbiome in adults and in neonates^{5,6}. On the other hand, damage to the microbiome has been linked with conditions such as asthma⁷, allergy⁸, juvenile idiopathic arthritis^{9,10}, type 1 diabetes¹¹, obesity^{12,13}, celiac disease¹⁴, mental illness¹⁵ in particular, obsessive-compulsive disorder (OCD), mental retardation and tic disorders, Crohn's disease¹⁶ and impaired neurocognitive outcomes¹⁷. For these reasons continuous survey of antimicrobial use and ADR monitoring is an integral part of better management outcome. There is limited data in this respect with regards to use of antibiotics in the pediatric population.^{18,19} No current data from our hospital is available.

Against this background we have planned to observe the antimicrobial use in the pediatric medicine ward of our hospital in order to generate some data regarding antimicrobial use and related ADRs. This

can serve as reference data for future studies in similar settings.

Materials and Methods

Settings and Facility Selection: This cross-sectional observational study was conducted over three months period from August, 2025 to November 2025 and carried by surveying patients admitted to Paediatric Medicine ward, Burdwan Medical College & Hospital, Burdwan, a tertiary care center.

Objectives

Primary Objective: To enumerate the profile of antimicrobials used in pediatric ward and pediatric intensive care unit (PICU) of BMCH, Burdwan.

Secondary Objective: To detect the incidence and nature of ADRs and to assess causality assessment to use of such antimicrobials.

Inclusion Criteria: All children of either sex admitted to paediatric Medicine IPD both ward and PICU from 1 month to 12 yrs and informed consent of any parents or legally acceptable representative of each subject.

Exclusion Criteria: unwillingness on the part of parents or legally acceptable representative to provide informed consent.

Data Collection Methodology: After getting approval of BMCH Ethics Committee, written informed consent (assent) was obtained from both parent or legally acceptable representative of each subject up to 7yrs of age. For children aged between 7 (84 months and above) and 12 years of age, verbal or oral assent was obtained in the presence of parents or LAR and was recorded. On every study day, the first 10 newly admitted cases were recruited into the study and observed till their discharge from hospital. Parameter included in this study were demographic variables (age, sex), Clinical variables (body weight, indication for admission, co-morbidities), Duration of hospital stay, Necessity for PICU admission, range of antimicrobials received with dosing and indication and ADRs suspected to be related to antimicrobial use. The assessment parameters for the study were primarily clinical. No special equipment or investigational procedure was required for the study.

Sample Size: A total of 102 patients were screened.

Data Management: Data were analyzed in the Department of Pharmacology & Therapeutics, BMCH, Burdwan. Data were captured on a predesigned structured CRF for each subject. Subjects were screened for antimicrobial use by any route, including oral, parenteral and topical. If a suspected ADR was encountered, data relevant to this was captured on a standard ADR monitoring form recommended by National Pharmacovigilance Program of India. Causality assessment was done on the basis of World Health Organization – Uppsala Monitoring Centre criteria²⁰ and by Naranjo's algorithm²¹.

Statistical Analysis

Following data collection, data was entered into Microsoft excel worksheet (Microsoft, USA). Data analysis was done using IBM Statistical Package for Social Sciences. Categorical data was described in terms of frequencies and percentage. Key proportions were expressed in 95% Confidence Interval. Subgroup comparison was done by Student's unpaired t-test for normally distributed numerical variables, or by Mann-Whitney U-test, if not normally distributed. Fisher's exact test or Pearson's Chi-square test was employed for intergroup comparison of categorical variables. All analyses were 2-tailed. Statistically significant implies a *p* – value of < 0.05.

Ethical approval: The study is approved by the Institutional Ethics Committee of BMCH.

Results and Analysis

Baseline Variables: In this study the median age of admission was 60 months (Mean \pm SD: 134 months \pm 2.83) and female child contributed 34.39% (n=35) of total population. The median birth-weight was 2.5 kg with a median weight at admission 15 kg (Mean \pm SD: 15.8 kg \pm 7.07).

Indications of antimicrobial used: The total number of primary infection cases getting empiric antimicrobial therapy was 63 and specific therapy after obtaining culture-sensitivity report was applied only on 7 cases and antimicrobials used as prophylaxis in 32 cases. In most of the cases, in the empiric antimicrobial group the primary source of infection was lower respiratory tract (25.71%) and C.N.S (24.29) followed by multi-organ dysfunction secondary to sepsis (20%), urogenital (12.86%), G.I (10%), and skin & soft-tissue infections (8.57%).

Profile, range & pattern of antimicrobials: Total number of antimicrobials used were 251; most of the cases were being antibacterials (87.64%), followed by antiprotozoal (8.36), antivirals (3.58%), & anthelmintic agents (0.57%). Most commonly used antibacterials were ceftriaxone, amikacin, amoxicillin-clavulanate and vancomycin. Among the antiprotozoal, antiviral & anthelmintic agents artesunate, acyclovir and albendazole were used respectively. The range of antibacterials used and number of cases is shown in fig.1.

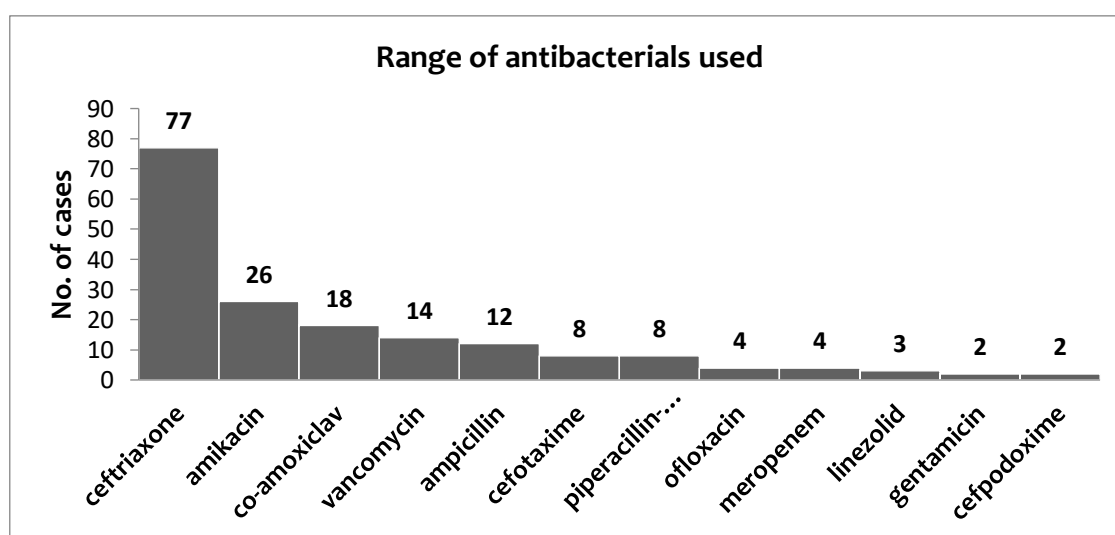


Fig-1: The range and number of antibacterials.

Among the total number of cases 71.57% patients received only parenteral therapy and 22.55% patients received parenteral followed by oral therapy. Average number of antimicrobials received per patient was 2.46. Median duration of hospital-stay in patients receiving antimicrobials was 10 days. Number of PICU admission (antimicrobials used in all cases) were 20 (19.61%).

Suspected ADR profile: In our study, diarrhea was the most common adverse drug reactions related to antimicrobials which were encountered in 5 cases, followed by maculopapular skin rash, erythematous skin rash and raised creatinine value. In all the cases remission occurred upon withdrawal of the offending agent (Tab-1 & Fig-2).

Table-1: Types and number of ADRs

ADRs	Drugs	Outcome	Number
Diarrhea	Ceftriaxone	Remission on withdrawal	4
	Co-amoxiclav		1
Maculopapular rash	Vancomycin	Remission on withdrawal	4
Erythematous rash	Cefpodoxime	Recovered	1
Raised creatinine	Amikacin	Remission on withdrawal	1

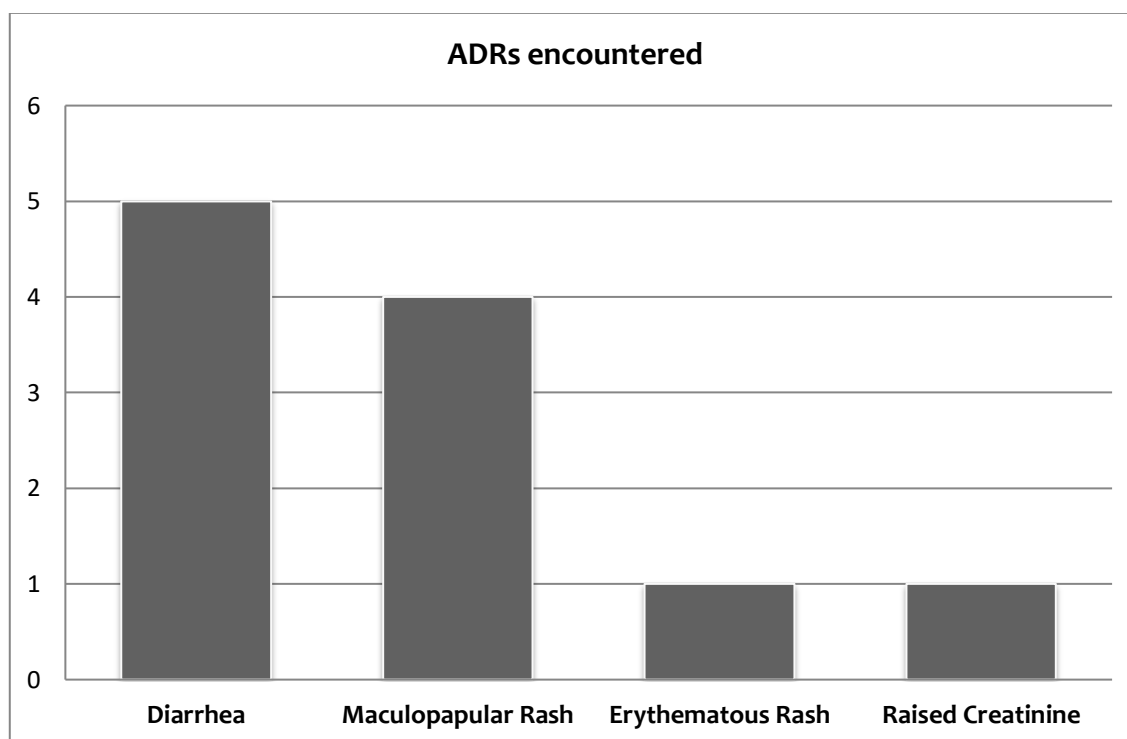


Fig-2: Pattern and number of ADRs

Discussion

Antibiotics represent one of the most commonly used medicine. There is relatively little knowledge and understanding about antimicrobial use in paediatrics and neonates. In developed countries antimicrobials usage data is available from pharmacy stock

information centre but in our setup no such facility is available. The spectrum of antimicrobials as well as their indications varies considerably from time to time and country to country.

In a cross-sectional study using point prevalence survey (PPS) in 61 paediatric units across the UK

done by Gharbi M, et al.²² showed that a total of 1247 (40.9%) of 3047 children hospitalised on the day of the PPS were on antibiotics. General paediatrics units were surprisingly high prescribers of critical broad-spectrum antibiotics, such as carbapenems and piperacillin-tazobactam. Medical prophylaxis appeared to be one of the most common indications for antibiotic prescribing in children.

On the other hand, a study from Bangladesh²³ conducted over 2171 paediatric patients showed that pneumonia and diarrhoea were the two most common infectious diseases among them and the most commonly used antimicrobials were ampicillin, gentamicin, amoxicillin, cloxacillin and ceftriaxone. The majority of the admitted paediatric patients (56.1%) included in this study received two or more antimicrobials in combination for their treatment.

A study from sub-urban area of India²⁴, done on 347 children revealed that respiratory tract diseases (30.5%) and infectious diseases (26.1%) were the most common reasons for hospitalization. Tuberculosis was the most common infectious disease seen among the hospitalized children. The observers found that ampicillin was the most commonly used antimicrobial and approximately two thirds of patients received parenteral therapy. Adverse drug reactions were seen in 1.7% of the children in the study.

In a study from New Zealand²⁵ that includes 3160 paediatric prescriptions and ADRs were found in 67 cases (2.12%).

Yet another study from Indonesia²⁶ by Amin Husni et al which included 356 patients of 1 day to 18 years of age found that the antibiotics most commonly used singly was cefotaxime (49.4%) and the combination of antibiotic mostly used was ampicillin + chloramphenicol (34.5%). In majority of such cases antibiotics were started on the basis of clinical diagnosis.

Similar result was obtained from a study conducted in Nepal²⁷ among 121 patients who were clinically diagnosed with infectious diseases and treated with antibiotics; and specimens were taken for culture in only 24 cases i.e. (19.8%) to identify pathogenic

organisms. Only 13 specimens showed positive culture results.

In our study we also found same trends as in other developing countries. Empirical antimicrobials were given in majority of cases and the most common indication was LRTI & C.N.S (25.71% and 24.29% respectively). The most commonly used antibiotic was ceftriaxone and 75.4% patients received parenteral therapy. ADRs were encountered in 11.76% cases, most common being are vancomycin induced Maculopapular rash and antibiotic induced diarrhea.

Conclusions

Empiric antimicrobials use could be decreased. Lower respiratory tract infection and central nervous system infection were the most common indications of antimicrobial use in paediatric population in our setting. Vancomycin is the most frequently encountered offending agent causing ADR in form of maculopapular rash, found in 35.71% (5 out of 14) of vancomycin use cases. Antibiotics associated diarrhoea is another most common form of ADR identified. Antibiotics induced ADRs are limited in number and severity, and usually can be managed by early recognition and withdrawal of the offending agent.

Limitations

1. Relatively small sample size, include only 102 pediatric population were included.
2. In cases with antimicrobial associated diarrhea, other probable cause of infectious diarrhea was not ruled out by stool culture or by other method like, toxin assay due to lack of resources and proper lab-support.

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