



Prescribing Pattern & Cost-Identification Analysis of Antimicrobial Use in Respiratory Tract Infections

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Abstract

The objective of an observational study was to evaluate the drug prescribing pattern in the pediatric population in a tertiary care teaching hospital. The most common illness, which warranted admission to PICU, was bronchopneumonia (33.3%) followed by bronchiolitis (17.5%) and bronchial asthma (7.9%). Average no. of Antimicrobial Agents received per patient was 3.9. Parenteral drugs accounted for 86.1% of the total drugs prescribed. The most common AMAs prescribed were cephalosporins (26.1%), aminoglycosides (20.9%), beta-lactams (excluding cephalosporins) (17.4%) and fluoroquinolones (11.1%). Beta-lactams contributed to 44% of the total AMA cost followed by cephalosporins (31.8%) and miscellaneous AMAs (8.5%). The total number of preparation encounter per prescription was 9.7 ± 4.8 per patient. The total number of single drug prescription was 88.4% and fixed drug combinations were 11.6%. Among the total drugs prescribed, 45.26% were generic and 54.73% constituted branded drugs. Overall 51% of the total drugs prescribed were from the WHO List of Essential Medicine 2010. There should be more emphasis on prescribing generic drugs and in case of similar efficacy the drug with lesser cost should be preferred.

Key Words

Pediatrics, Prescribing Pattern, Antimicrobial, Respiratory Tract Infections

Introduction

Respiratory tract infections are common in children which may require treatment with antimicrobial agents (AMAs). Widespread use of antimicrobials in intensive care unit (ICU) and ward invariably leads to emergence and dissemination of resistant bacteria (1-3). Since systemic antibiotics account for one-third of all prescriptions in preschool children (4,5) pediatric antibiotic prescriptions are a major concern in terms of public health. Approximately 70% of all antibiotics in children are prescribed for upper respiratory tract infections (URTI) and streptococcus pneumoniae being the most common pathogen causing URTI. It is widely known that the spread of antibiotic resistance in Streptococcus pneumoniae is enhanced in younger children (6). Antimicrobial resistant bacteria have become a significant problem in pediatric intensive care unit (PICU), which necessitates the monitoring of the antibiotic use (7). LRTIs are treated mainly on OPD basis and moreover URTIs are mostly viral and do not require the administration of antibiotics.

Drug utilization has been defined as "the prescribing, dispensing and ingesting of drugs" (8). Drug utilization substantially varies among different countries and even among health institutions within a country (9). The importance of drug utilization in many research initiatives lies in the fact that it examines the clinical and economic effectiveness of pharmacotherapy apart from providing further input into utilization correlation with medication effectiveness, prescribing habits, and time dependencies (10). Although, controlling cost is the basic issue, it also affects the national budget, which is crucial in developing countries, where resources are limited. Drug utilization in the pediatric pharmacotherapy focuses on examination of prescribing trends in clinical settings, formulating standard treatment guidelines and promoting rational drug use. Prescribing pattern helps in evaluating local consumption/resistance pattern for optimized therapeutic effect of medications. It also helps in planning various steps to be taken to minimize adverse drug reactions as

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children are more vulnerable to them (11) and to provide cost effective medical care. Drug utilization helps in evaluating the usage of drugs in terms of medical, social and economic aspects. The aim of this study was to evaluate the prescribing pattern (Base line data) and pharmacoconomics of anti-microbial agents (AMAs) in respiratory tract infections in the pediatric population.

Material and Methods

It was an observational study carried out in the Pediatric ward and ICU of a tertiary care teaching hospital in Northern India. The study population included children with upper or lower respiratory tract infections. The study was approved from Institutional Ethics Committee. The Inclusion criteria constituted evaluations of medical records of patients (neonate to 15 yrs old) admitted in pediatrics ward. Patients from other wards were not included. Written informed consent was taken and prospective data regarding medications use was collected and entered in a structured proforma. Baseline data record included patients' demographics, diagnosis, dosage, dosage form and route of administration of drugs prescribed, average number of AMAs/patient, route of administration, category wise AMA prescription pattern, cost-analysis and outcome. To judge the quality of care in intensive care unit, the other parameters that were evaluated were mortality rate, average length of ICU stay, average number of patients requiring mechanical ventilation was taken. The drugs prescribed during the period of hospitalization in ICU were noted. Mean \pm SD number of drugs was calculated. Frequency of prescribing of drugs belonging to different group was recorded. The drugs were classified as according to Anatomical Therapeutic Chemical (ATC) classification (organ or system on which they act and their chemical, pharmacological and therapeutic properties). WHO essential medicine list was used to quantify the percentage of drugs being used in the paediatric population from WHO essential medicine list.

Results

Fifty nine pediatric patients fulfilled the inclusion criteria. They were enrolled from pediatric ward and intensive care unit during the study period. Thirty seven (62.7%) were male and twenty two (37.3%) were female. 29 were aged between 2 to 14 years, 27 were less than 1 year of age and 3 were from the age group 1 to 2 yrs. A total of 89.8% were term deliveries, 8.47% were preterm and 1.69% were post term deliveries. Among all the patients, 44 (74.6%) were vaginal deliveries and 15 (25.4%) were delivered by caesarean section. Average no. of AMAs received per patient was 3.9. Parenteral drugs accounted for 86.1% of the total drugs

prescribed (Table 1). The most common illness, which warranted admission to PICU, was bronchopneumonia (33.3%) followed by bronchiolitis (17.5%) and bronchial asthma (7.9%) (Fig 1). The most common AMAs prescribed were cephalosporins 26.1%, aminoglycosides 20.9%, beta-lactams (excluding cephalosporins) 17.4% and fluoroquinolones 11.1% (Table 2, Fig 2). The subgroup analysis showed that commonly prescribed AMAs were cefepime (35%), ceftriaxone (23.3%) and cefoperazone plus sulbactam (21.6%) among cephalosporins; amikacin (91.6%) among aminoglycosides; amoxicillin plus clavulanic acid (47.5%), cloxacillin (17.5%) and meropenem (15%) among beta-lactams (except cephalosporins). Maximum number of drug were prescribed by intravenous route (Fig 3). Average cost of AMA per patient for the total hospital stay was Rs 6942. Beta-lactams contributed to 44% of the total AMA cost followed by cephalosporins (31.8%) and miscellaneous AMAs (8.5%) (Fig 4). The average duration of stay of patients was 12.3 days. The total number of preparation encounter per prescription was 9.7 ± 4.8 per patient. The total number of single drug prescription was 88.4% and fixed drug combinations were 11.6%. Among the total drugs prescribed, 45.26% were generic and 54.73% constituted branded drugs. Overall 51% of the total drugs prescribed were from the WHO List of Essential Medicine 2010. The outcome was favorable in 84.7% of the patient

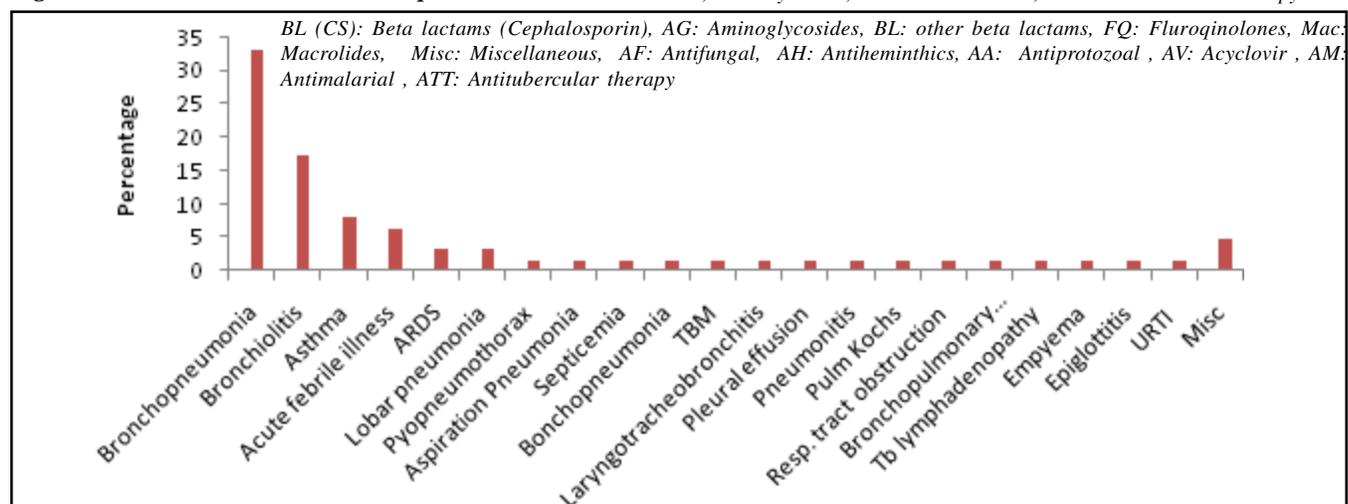
Discussion

This study has given us an overall pattern of antimicrobial drug use profile in pediatric patients with respiratory infections. Majority of the patients were males as compared to the females presenting with respiratory tract infections. Respiratory infections have been predominantly observed in the literature among the males in pediatric population with respiratory tract infections (12). Another observation was indeed the greater number of full term normal vaginal deliveries, hence pointing towards better maternal care during antenatal period in the patients catered by our hospital. The average number of drugs being prescribed per patient is 3.9, which is lesser than that observed in another study conducted by Palike N et al in pediatric patients (13). Most of the cases were of bronchopneumonia, followed by bronchiolitis and by bronchial asthma. This pattern is commonly seen in India with regards to respiratory tract infections. Bronchopneumonia has been the major cause of the respiratory tract infection in ICU settings (14). Since these are mainly infectious in aetiology, this lead to higher antibiotic usage, which has been previously observed in studies conducted by Chatterji S and Karand S (15,16).

**Table.1 Prescription Trends in Pediatric Population**

Total No. of patients (N)	59
Average no. of AMAs/patient	3.9
Most commonly used ROA	IV (86.1%)
Average cost of AMA/patient	Rs 6942
Favorable outcome	84.7%

As shown in the Table 2, total antibiotic usage, included both intravenous and oral antibiotics, of which beta-lactams were maximally prescribed. All the antibiotics, were targeted for upper and lower respiratory tract infections (URI and LRTI). Among the beta-lactams, cephalosporins were prescribed to the maximum number of patients, which may be similar to the study conducted by other authors (13). Third generation cephalosporins were prescribed more frequently, which may be because that ours is a tertiary care hospital, and patients would have already been administered and

Fig.1 Disease Pattern in Pediatric Population

probably developed resistance to lower generation antibiotics. Majority of the drugs were given by intravenous route followed by the oral route. This mainly indicates that patients are admitted in wards or ICUs for LRTI and hence IV route is necessary for rapid control of infections and minimise morbidity as compared to oral route. Dimri *et al* conducted a similar study describing WHO core indicators, drugs prescribed from WHO essential medicine list, apart from baseline data which included patients' demographics characteristics, diagnosis, dosage, dosage form and route of administration of drugs prescribed (17). It differs from our study regarding its large sample size and enrolment of outpatient pediatric patient on the contrary our study evaluated cost, primary

Table.2 Major Drug Group along with ATC Codes

Drug gp	No. of Patients	ATC code	% patients
BL(CS)	60	J01D	26.08
AG	48	J01G	20.86
BL	40	J01C	17.39
FQ	24	J01M	10.43
Mac	18	J01F	7.82
Misc	16	-	6.95
AF	15	D01	6.52
AH	3	P02	1.3
AA	2	P01	0.86
AV	2	J05	0.86
AM	1	P01	0.43
ATT	1	J01	0.43
	230		100

BL (CS): Beta lactams (Cephalosporin), AG: Aminoglycosides, BL: other beta lactams, FQ: Fluroquinolones, Mac: Macrolides, Misc: Miscellaneous, AF: Antifungal, AH: Antihemithics, AA: Antiprotozoal, AV: Acyclovir, AM: Antimalarial, ATT: Antitubercular therapy

diagnosis and drugs with their ATC codes. From our study, majority of the antibiotics were prescribed on an empirical basis without pathogen identification or antibiotic susceptibility test. The study was conducted in winter months as RTIs are more common in winters. The cost accounted approximately Rs 6942 per patient. Beta lactams followed by amino glycoside accounted for the maximal costs of the antimicrobials. Our hospital is a major referral centre of the state, newer generation of AMAs as patients have already developed resistance to older generation of antibiotics are more commonly prescribed which leads to the increased cost. The lesser number of drugs being utilized from the WHO essential medicine list points towards an urgent need to use of

Fig.2 Category wise AMA Prescription

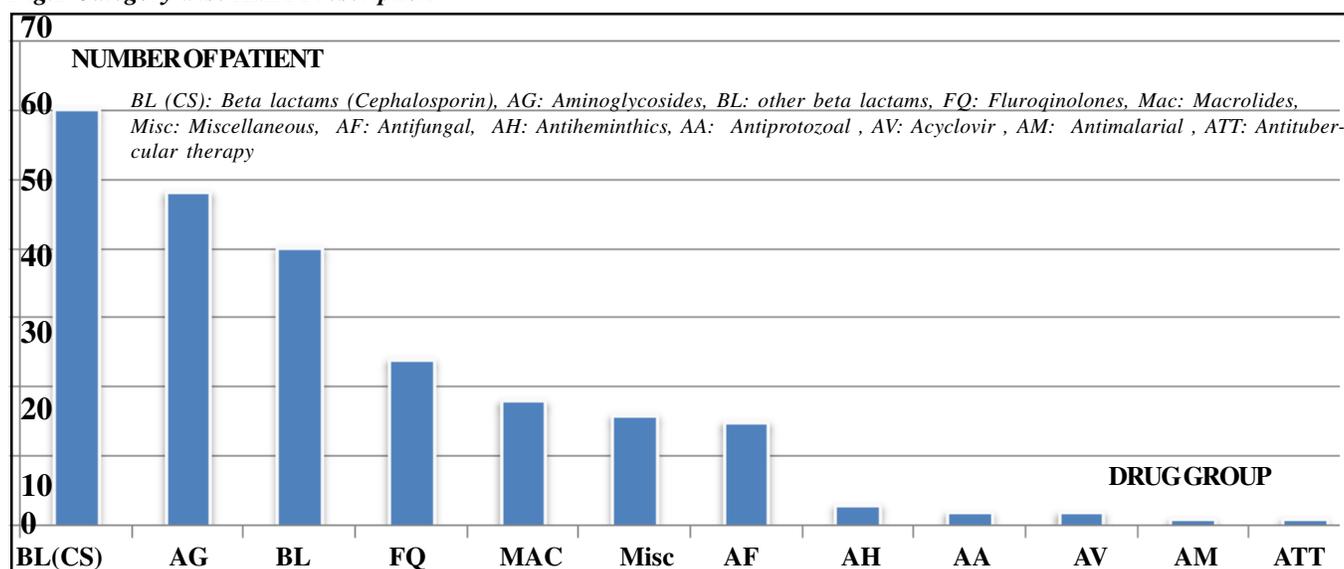
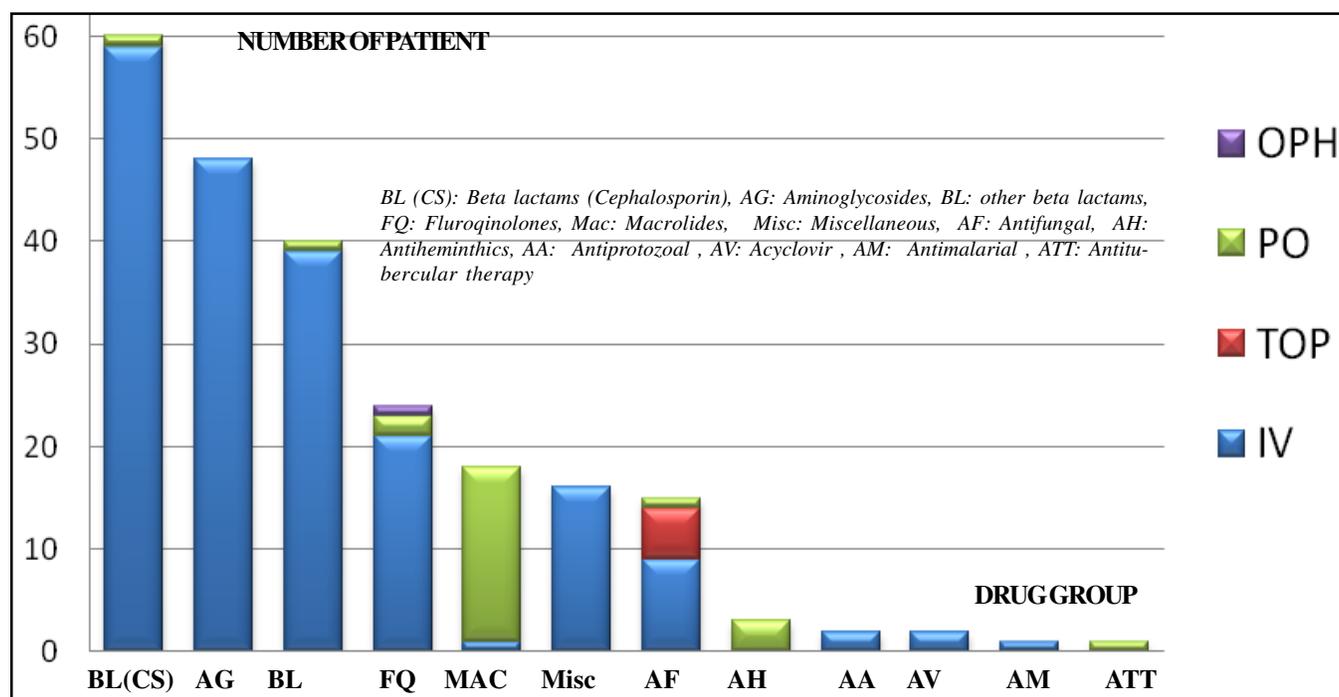


Fig.3 Route wise AMA Prescription



drugs from essential medicine list. More usage of branded drugs and lesser usage of generic again needs to stresses on the need to inculcate the habit of using generic drugs. This preliminary study helped us to identify the pattern of AMA prescribing based on which future intervention studies may be planned to promote rational drug use. Using this study as a template, antibiogram has been started to get an idea of antibiotic C/S in different areas of the hospital. AMA

policy is being framed. As resources for pediatric studies are limited, we must develop methods that rationally prioritize which prescribed drugs, and which pediatric subpopulations, are to be studied. Our study has some limitations. The sample size was small. Moreover, the study period covered was only two months.

Conclusions

Newer generation of AMAs more commonly prescribed leading to increased cost of therapy. Most

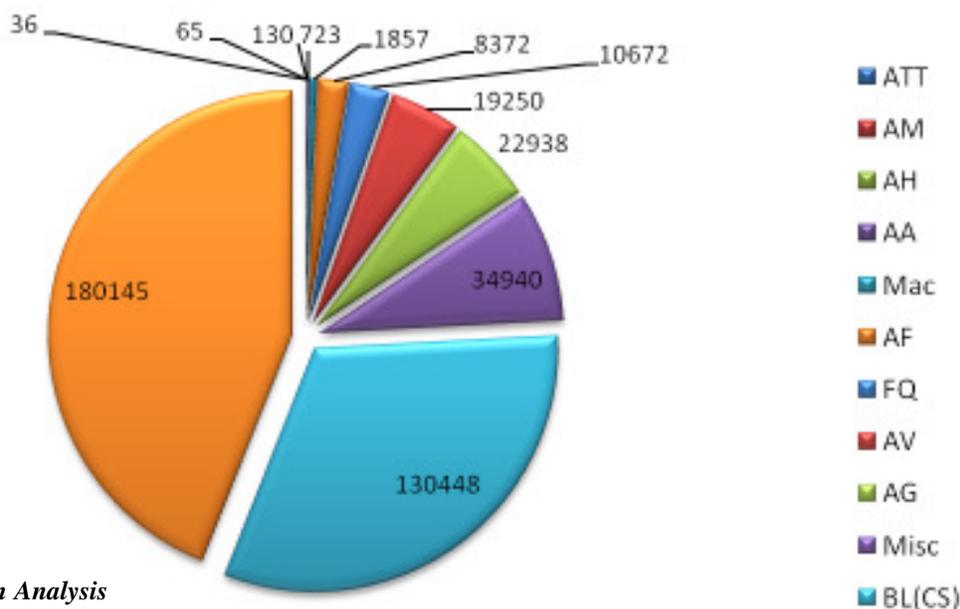


Fig.4 Cost Identification Analysis

commonly prescribed AMAs were Betalactams (including CS) followed by amino glycosides. Both these groups contribute to the major portion of the cost. Most common ROA was Intravenous. Preparation of Standard Treatment Guidelines is under the way to promote judicious use of AMAs

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