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Assessment of Antibiotic Use in Pediatric Patients at a Tertiary care Teaching Hospital

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Abstract

Emergence of resistant bacterial pathogens has increased concerns about antibiotic prescribing patterns. The aim of the study was to assess the antibiotic use in pediatric patients. The study was carried out in a 500 bedded multi-speciality tertiary care teaching hospital at Coimbatore for the period of eight months from May 2007 to December 2007. During the study period, all inpatients of the pediatric ward that were prescribed with antibiotics were screened. The study result showed that there were a total of 214 (52.5%) cases prescribed with antibiotics. The major disorders for which antibiotics were prescribed included acute gastroenteritis (15%), lower respiratory tract infections, (14.5) upper respiratory tract infections (13.5%) and pyrexia of unknown origin (13.5%). In only 13.6% of the cases culture and sensitivity test was done and in 9.3% of the cases, micro-organisms were isolated. The organisms isolated were Streptococcus pneumoniae (3.7%), Staphylococcus aureus (1.9%), Pseudomonas aeruginosa (0.9%) and E.coli (2.8%). The most commonly prescribed antibiotic class was cephalosporins (68.2%). The most frequently prescribed antibiotic was cefuroxime (22.9%) and the commonly used antibiotic combination was cephalosporin with aminoglycoside (6.5%). The study result showed that ampicillin was the antibiotic used commonly to treat acute gastroenteritis (75%); cefuroxime for both lower respiratory tract infections (81.3%) and asthma (50%); amoxicillin/clavulanate potassium for both upper respiratory tract infections (41.4%) and pyrexia of unknown origin (34.5%); ceftriaxone/sulbactum for both acute otitis media and seizure disorder (69.2%) respectively.

Key words: *Antibiotics, Organisms, Antibiotic use, Pediatrics*

INTRODUCTION

Emergence of resistant bacterial pathogens has increased concerns about antibiotic prescribing patterns[1]. During the last decennia, antibiotic resistance is on the rise[2]. This is mainly due to the abuse of broad-spectrum antibiotics in first-line treatment, or erroneous use (e.g. treatment of viral respiratory tract infections), use of multiple courses (e.g. cystic fibrosis patients) or prolonged duration of antibiotic treatment. The prevalence of more specialized pathologies requiring intensive antibiotic therapy or prolonged hospitalization, immunosuppressed conditions, invasive techniques put the children at high risk for opportunistic or nosocomial infections[3].

Healthcare professionals have a responsibility of creating a safe medication environment and reducing risk to a vulnerable pediatric population. Over prescribing not only cause non compliance and increased side effects, but also adds to the financial burden of patients[4]. To overcome the above problems and to assure safe and cost effective therapy, antibiotic guidelines are required in a hospital setup. By definition, "Antibiotic guidelines are standard set of guidelines for the treatment of infectious diseases based on local culture sensitivity data." These guidelines help the physician to handle the antibiotics with caution and use them in the right dose and for the right duration only when definitely indicated. This will improve the quality of prescribing and may help in overcoming the problems associated with improper use of antibiotics.

MATERIALS AND METHODS

Study site

The study was conducted in the department of Pediatrics at a 500-bedded multi-specialty medical institution; and one of the largest hospitals in Coimbatore. The reason for the selection of the department of pediatrics was that, the pilot study revealed more scope for the study in the department of pediatrics as the prevalence of antimicrobial prescription is more.

Study period

The study was carried out for the period of eight months from May 2007 to December 2007.

Study design

Prospective-Observational study

Patient selection

All the patients who were prescribed with antibiotics in the Pediatric ward were included in the study. Only inpatients were included in the study. The outpatients and intensive care patients were excluded in the study.

Study approval

The protocol of the study that includes the objectives and methodology was submitted to the Dean of the study hospital. The authorization from the Dean was procured on 5th May 2007 as per SRH/DEAN/F. 19/2007-2008. The author was permitted to utilize the hospital facilities to make a follow up of the prescriptions in the selected department.

Study material

A specially designed data entry format was used to enter all patient's details like patient name, age, sex, weight, inpatient number, date of admission, date of discharge, reason for admission, past medical history, food habits, known allergies, previous ADRs, any surgical procedures done, vital signs like temperature, BP and pulse. Provision is given in the format to enter laboratory investigations, specimen collected, organisms identified, sensitivity to various antibiotics, diagnosis made, number of drugs prescribed and category of antibiotics prescribed.

Study procedure

The study was carried out in three phases. A pilot study was carried out for a period of two weeks in the Department of Pediatrics to find the scope of the study in this department. All the antibiotic containing prescriptions were monitored to know the frequency and extent of antibiotic use and also for conditions in which it was prescribed. The study protocol was designed and the necessity of the study was explained to the chief pediatrician of the study hospital. The consent form from the hospital authority was obtained during this phase. Literatures, which support the study, were collected and were reviewed for study on importance of antibiotic prescribing patterns in pediatrics. A standard data entry format for collecting patient details was designed and, during the ward rounds the entire patient data with special reference to the antibiotic prescribed were recorded in the format. The details regarding the results obtained from the study, which were evaluated, were made as a report and were submitted to the concerned department along with the guidelines.

RESULTS AND DISCUSSION

During the study period, a total of 408 patients were admitted in the pediatric ward. Out of which, 214 (52.5%) children were prescribed with antibiotics for the treatment of various disorders. Sixty (28%) of the study patients fall between the age group of =2 years <5 years, and between the age group of =5 years <12 years, there were 56 (26.2%) patients. In general, more patients were between the age group of 2 to 12 years. Similar studies conducted by Chkhaidge I (2006)[5] revealed that the incidence of infection is lowest in the age group up to 6 months. The duration of stay for maximum number of children (65.4%) were between 4 to 5 days, which is normally required to complete the recommended schedule of antibiotics. Similar study conducted by Ufer M et al in 2005 indicated that the mean treatment duration was directly proportional to the hospital stay[6]. The major reason for the admission was fever (72%) which most of the times is the major indicator for infection and requires antibiotic use. The other reasons for admission were cough (29.9%) and dyspnea (26.6%). Major disorders observed for which antibiotics prescribed in the department of pediatrics were acute gastroenteritis (15%), lower respiratory tract infections (14.5%), upper respiratory tract infections (13.5%), pyrexia of unknown origin (13.5%) and otitis media (6.1%) (Table1). Other disorders include viral pyrexia, enteric fever, fits, and bronchiolitis. Similar studies conducted by Jonathan A Finkelstein in 2001 reported that otitis media accounted for the majority of antibiotic courses dispensed[7]. Out of 214 cases prescribed with antibiotics, only for 29 (13.6%) cases, culture and sensitivity test was done; and micro-organism was isolated in 20 (9.3%) cases (Table 2). As the sensitivity pattern studies reflect the major organism to be treated, it helps to choose the appropriate antibiotics resulting in appropriate antibiotic therapy. Of all the cases analyzed, 32.7% patients were prescribed with 3 drugs per prescription. 27.6% prescription contained 2 drugs and 17.3% prescription contained 4 drugs per prescription. The average number of drugs per prescription was 3.3. Majority of the patients were treated with single antibiotic (84.6%). Two antibiotics were prescribed in 11.2% cases and three antibiotics were prescribed in 3.7% cases. Only in one case (0.5%) four antibiotics were prescribed (Fig. 1). Even though antibiotic combination therapy may be effective as an initial approach to resistant organisms, it should be confirmed by sensitivity pattern studies. Various

categories of antibiotics prescribed were analyzed (Fig.2), which revealed that cephalosporins were prescribed widely in 146 (68.2%) prescriptions followed by penicillins in 68 (31.3%) prescriptions. Similar studies conducted by Sandra R Arnold in 1999 revealed that antibiotics from the penicillin class were the most frequently prescribed. Other categories of antibiotics prescribed include aminoglycosides (8.9%), macrolides (6.1%) fluoroquinolones (4.7%) and sulfonamide (0.5%). Similar studies conducted by Christopher J Stille et al in 2004 revealed that second generation macrolides use among children increased greatly, in contrast to the nationwide decrease in antibiotic use[8]. Cefuroxime was the most frequently prescribed antibiotic (Table 3). It was prescribed in 49 (22.9%) cases followed by ceftriaxone/sulbactum in 43 (20.1%) prescriptions, amoxicillin/clavulanate potassium in 36(16.8%) prescriptions, ampicillin in 30 (14%) prescriptions and ceftriaxone in 29 (13.5%) prescriptions respectively. Other commonly prescribed antibiotics were roxithromycin, gentamicin, and ceftriaxone/tazobactum. Antibiotic combinations commonly used (Fig.3) were found to be cephalosporin+ aminogycoside (6.5%),cephalosporin+ macrolide(1.9%) and penicillin+

aminoglycoside (0.9%). Combination therapy as an approach to reducing bacterial resistance has potential, but additional studies are required to provide adequate support for its use. Of the 258 antibiotics administered, 203 (94.9%) were administered through IV route and 54 (25.2%) were administered through oral route. The study on the usage of antibiotics for various disorders revealed that ampicillin was the antibiotic used commonly to treat acute gastroenteritis (75%); cefuroxime for lower respiratory tract infections (81.3%) and asthma (50%); amoxicillin/clavulanate potassium for both upper respiratory tract infections (41.4%) and pyrexia of unknown origin (34.5%) and Ceftriaxone/Sulbactum for both acute otitis media and seizure disorder (69.2%) respectively (Table 4). Similar studies conducted by Robin E Huebner in 2003 revealed that cephalosporins were used most frequently to treat penicillin-resistant pneumococcal disease[9]. The other classes of drugs prescribed along with the antibiotics were also analyzed. The major classes of drugs prescribed were NSAIDs (69.2%), bronchodilators (26.6%), expecto-rants (21.5%), antidiarrheals (15%), and antihistamines (14.5%).

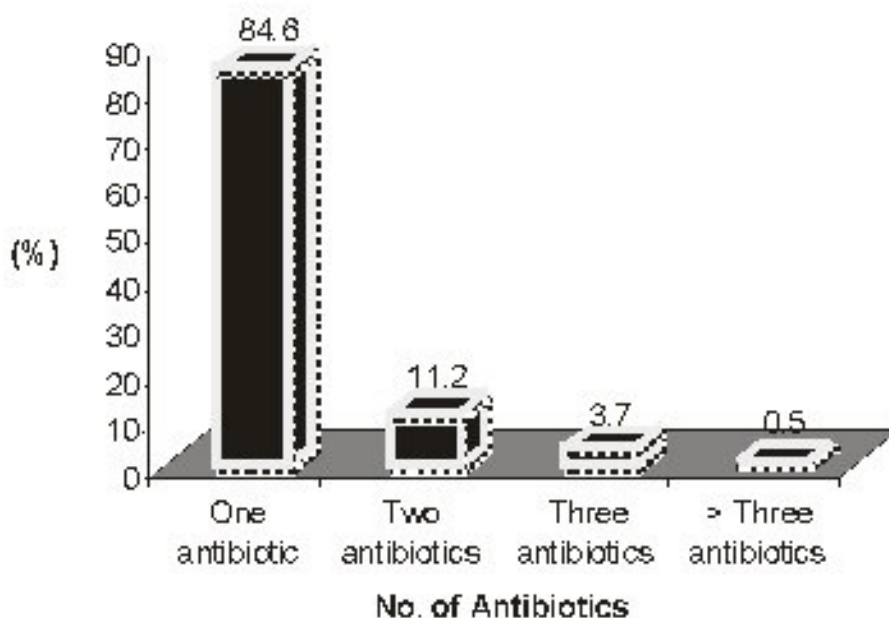*Figure 1: Number of antibiotics prescribed per prescription (n=214)*

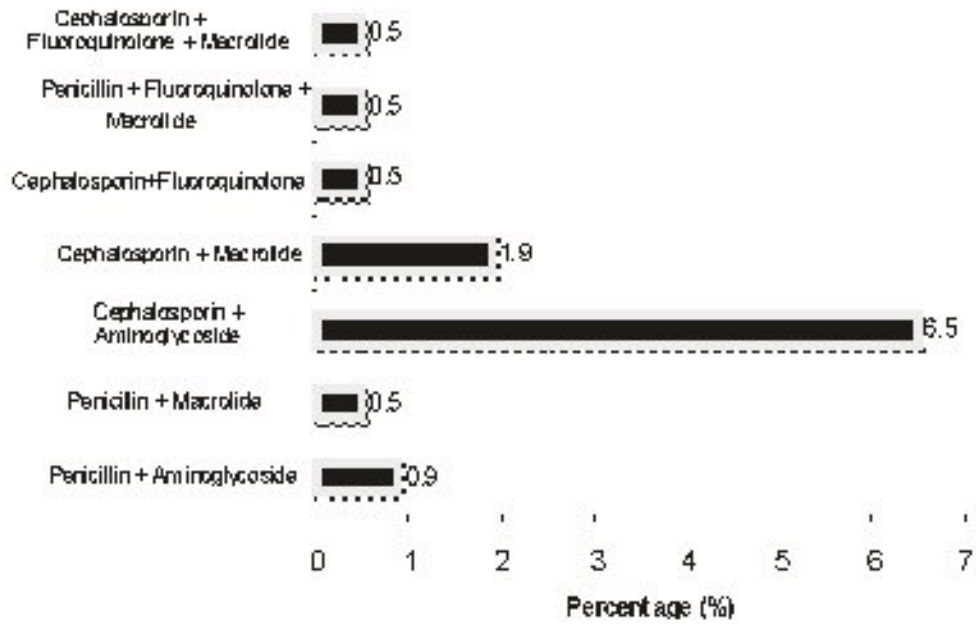**Figure 2: Various category of antibiotics prescribed (n=214)p**
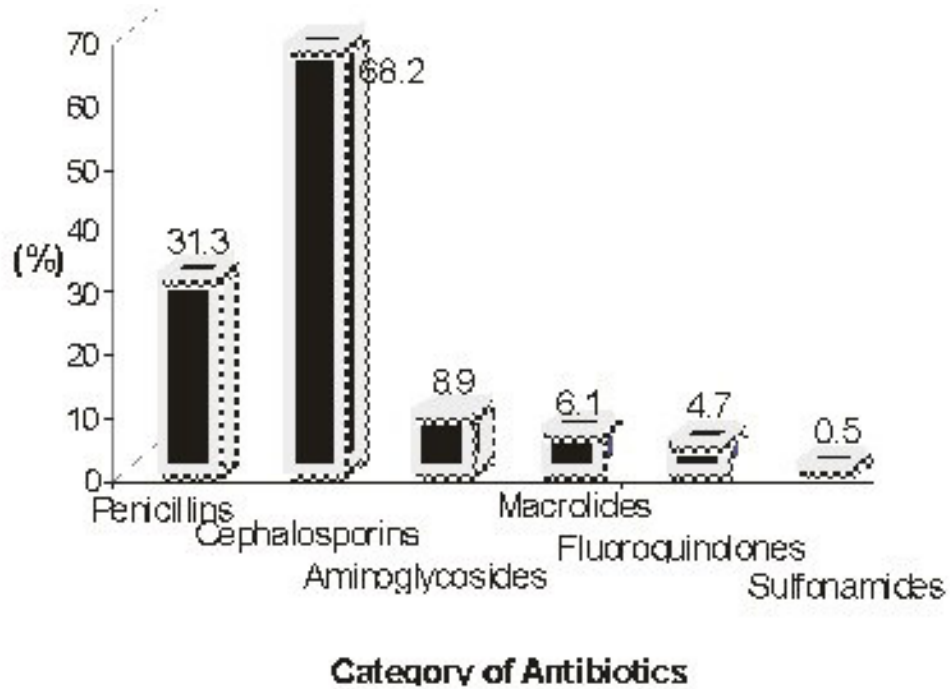

Figure 3: Antibiotic combinations used (n=214)

Table No. 1: Various clinical conditions treated with antibiotics (n=214)

Disorders	No. of Patients	Percentage (%)
Acute gastro-enteritis	32	15
Lower respiratory tract infections	31	14.5
Upper respiratory tract infections	29	13.5
Acute otitis media	13	6.1
Bronchiolitis	6	2.8
Pneumonia	3	1.4
Asthma	12	5.6
Enteric fever	6	2.8
Urinary tract infections	4	1.9
Cellulitis	4	1.9
Appendicitis	1	0.5
Pyrexia of unknown origin	9	4.2
Viral pyrexia	6	2.8
Seizure disorder	13	6.1
Tuberculosis	1	0.5
Bowel infection	1	0.5
Meningitis	1	0.5
Others	46	21

Table No. 2: Sensitivity Pattern Studies (n=214)p

ORGANISMS	Patients Infected	Amikacin	Gentamycin	Netilmycin	Cefoperazone/ Sulbactam	Cefotaxone	Cefuroxime	Cefixime	Ceftazidime	Ciprofloxacin	Imipenem	Ofloxacin	Sparfloxacin	Carbenicillin	Piperacillin/ Tazobactam	Teicoplanin	Vancomycin	Co-trimoxazole	Linezolid	Nitrofurantoin
E.coli	6	6	1	6	6	1	-	5	-	3	6	5	6	1	6	-	6	3	-	1
Strep. Pneumonia	8	3	2	5	6	6	4	7	6	6	8	4	4	6	8	6	7	1	8	-
Pseudomonas	2	2	-	1	2	-	-	-	-	1	2	2	2	1	2	-	1	-	-	-
Staph. aureus	4	3	1	2	4	1	1	2	2	1	4	3	2	1	4	3	3	-	3	-

Table No. 3: Break up of antibiotics prescribed (n=214)

Antibiotics	No. of Prescriptions	Percentage (%)
Amoxicillin	01	00.5
Amoxicillin/pot. clavulanate	36	16.8
Ampicillin	30	14.0
Benzathine penicillin	01	00.5
Ceftriaxone	29	13.5
Ceftriaxone/Sulbactum	43	20.1
Ceftriaxone/Tazobactum	07	03.3
Cefuroxime	49	22.9
Cefixime	05	02.3
Cefipime	04	01.9
Cefipime/Tazobactum	02	00.9
Cefotaxime	03	01.4
Cefotaxime/Sulbactum	01	00.5
Cefaclor	01	00.5
Cefadroxyl	01	00.5
Cefdimir	01	00.5
Gentamycin	15	07.0
Amikacin	02	00.9
Netilmycin	01	00.5
Streptomycin	01	00.5
Clarithromycin	03	01.4
Roxithromycin	09	04.2
Azithromycin	01	00.5
Ofloxacin	07	03.3
Ciprofloxacin	02	00.9
Sparfloxacin	01	00.5
Co-trimoxazole	01	00.5

Table No. 4: Major Disorders VS Antibiotics Prescribed

Disorder	Antibiotics prescribed
Acute gastroenteritis	Ampicillin, Ofloxacin, amoxicillin/clavulanate pot., ceftriaxone, cotrimoxazole
Lower respiratory tract infections	Cefuroxime, ceftazidime, ceftriaxone/sulbactum, amoxicillin/clavulanate pot., roxithromycin, cefepime
Upper respiratory tract infections	amoxicillin/clavulanate pot., ceftriaxone, cefepime, ceftriaxone/sulbactum, cefuroxime, roxithromycin
Pyrexia of unknown origin	Amoxicillin/clavulanate pot., amoxicillin/clavulanate pot.+gentamycin, cefepime, ceftriaxone, ceftriaxone+gentamycin, amoxycillin+clarithromycin+gentamycin, ceftriaxone/sulbactum, ceftriaxone/tazobactum, cefuroxime, ciprofloxacin
Acute otitis media	Ceftriaxone/sulbactum, ceftriaxone/tazobactum, ceftriaxone, cefuroxime
Seizure disorder	Ceftriaxone/sulbactum, ceftriaxone/tazobactum, ceftriaxone+gentamycin, ceftriaxone
Asthma	Amoxicillin/clavulanate pot., cefuroxime, clarithromycin, roxithromycin
Enteric fever	Ceftriaxone, ceftriaxone/sulbactum, amoxicillin/clavulanate potassium
Bronchiolitis	Cefuroxime, cefuroxime+roxithromycin, amoxicillin/clavulanate potassium

As antibiotics share a very high percentage in any prescription, study on appropriate use of antibiotics and sensitivity pattern in the study hospital set up is to be conducted in periodic intervals. The study revealed that ampicillin was the antibiotic used widely to treat acute gastroenteritis; and cefuroxime for lower respiratory tract infections. When prescribing antibiotics, the knowledge on the organisms prevailing and the sensitivity pattern of antibiotics in the study hospital will help the health care professionals to select the appropriate one. Development of antibiotic policy for the study department is very much essential.

ACKNOWLEDGEMENT

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