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Original Research Article

A study on antibiotic prescription among the hospitalized pediatric patients at a referral center in Puducherry, India

M. Bala Gopal[1]*, P. Thiyagarajan[1], Vinayagamoorthy Venugopal[2], Venkata Naveen Kumar[3]

[1]Department of Pediatrics, [2]Department of Community Medicine, [3]Department of Pharmacology, Sri Manakulavinayagar Medical College and Hospital, Puducherry, India

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***Correspondence:**
Dr. M. Bala Gopal,
E-mail: gopalneo@yahoo.co.in

ABSTRACT

Background: Antimicrobial resistance has reached to a significant proportion globally. This antimicrobial resistance increases the cost of health care in addition to the existing burden of the prevalence of infectious disease in developing countries. We need to have institutional protocols based on the standard guidelines. It is important for the clinician to use antibiotics only when it is necessary. The aim of the study was to analyze the rationality of the antibiotics used among the hospitalized children in the referral centre located in the rural area, to evaluate the pattern of antibiotics prescribed among the hospitalized children and to find out the factors associated with the usage of antibiotics among them.
Methods: Analytical, cross sectional study was performed on all patients admitted to the inpatient pediatric medical service at a referral centre situated in the rural part of the Puducherry, India during the period from July 2015 to June 2016.
Results: 959 children were included in our study.607 children belong to less than 5 years of age group. Overall 60% of the children have received either oral or parenteral antibiotics. Based on the categorization of children as per the final clinical diagnosis children requiring antibiotic, can be used and not required are 13% (125), 38.6% (370) and 48.4% (464) respectively. Respiratory, gastrointestinal and systemic infectious diseases were the major group of cases admitted in our centre. Antibiotic use in respiratory and systemic infectious disease were maximum with 248 (70.1%) and 179 (71.6%) respectively. Among the antibiotics cephalosporin, penicillin group and azithromycin constitute more than 90% of the antibiotics prescribed cases.
Conclusions: Overuse of antibiotic is universal and seen in both developed and developing countries. This increases the cost of treatment and increases the chances of microbial resistance. As per the W.H.O. recommendations surveillance system is required in all the hospitals to assess the antibiotic use and to monitor the prevalence of microbial resistance.

Keywords: Antibiotic, Microbial, Resistance

INTRODUCTION

Antibiotic is one of the common drugs prescribed for the patients especially in inpatients. The antimicrobials have saved many lives from dreadful infectious diseases. It is a double-edged sword as its injudicious use will give rise to antimicrobial resistance that can endanger many patients life. The first antibacterial resistance was known in 1948. In the present 21st century every known pathogen is resistant to one or more antimicrobials.[1] Antibiotic medications are over used in both developed and developing countries. Indiscriminate use of drugs is an

important global threat.[2] The increase in resistance to antibiotics has made some bacterial infections encountered in P.I.C.U (pediatric intensive care) settings virtually impossible to treat.[2] We need to develop new antimicrobial and at the same time antibiotics has to be used judiciously. The data available on profile of antibiotic usage is less and its usage among pediatric patients is very meagre.

Data on the type of antibiotic usage, factors associated with its use and information on real need for antibiotic use will help the treating pediatrician to be aware of these findings and in turn will help them to avoid injudicious and indiscriminate use of antibiotics. Hence the present study was carried out to explore the pattern of antibiotics prescribed among the hospitalized children and to find out the factors associated with the usage of antibiotics among them. In 2011, the W.H.O's south east Region's health ministers adopted the Jaipur Declaration on Antimicrobial Resistance, which decided that combating antimicrobial resistance must be a priority for the national governments.[3] All major antimicrobial resistance control measures involve parents education, public awareness creation and sensitization of health care professionals. Multidisciplinary approach is required to overcome the current trends of antimicrobial resistance across the globe.[4]

METHODS

Analytical cross sectional study was done in a referral tertiary care hospital situated at rural part of Puducherry district of Pondicherry Union Territory, India.

Children admitted in the Pediatric department of the age group of 1month to 12 years from July 1st to June 30th were included in the study. Children who have discontinued (absconded after admission, discharged against medical advice and transferred to another centre) the treatment were excluded from the study.

Children admitted in the ward was assessed for eligibility and after obtaining the written informed consent from the parents, children case sheet were examined and study variables were collected from them. The study was approved by the institute research and ethical committee. Sample size was calculated to be 900, using the formula $4pd/d^2$, where p is the prevalence of antibiotic use, taken as 66% based on the previous study.[5] q is 100 minus p and d is the relative precision, that was taken as 5%, On an average 5 to 8 children get discharged per day from Pediatric ward. In order to collect the required data fulfilling the sample size, children discharging on alternate days during the study period were included in the study. Structured proforma was created and was pilot tested before initiating the data collection process. The data sheet contained patient's basic details, admission complaints, provisional diagnosis, investigations done and antimicrobials used. Patients were enrolled for the study group on the day of discharge where final diagnosis and the antimicrobials used during the course of stay were available completely. Trained junior resident working at the Pediatric department was used to obtain information. The patients were treated as per unit's protocol. To ensure the quality of the data collected, the extracted information was checked and verified by the other investigators regularly. Information regarding age, gender, chief complaints, laboratory investigations carried out like total WBC count, antimicrobials used was collected. 959 patients who provided complete data were included in the study as per inclusion criteria.

Chi-square test was used to find out the association between antibiotic use and factors associated with it. SPSS software version 24.0 was used for doing statistical analysis and p-value less than 0.05 was considered as statistically significant.

RESULTS

1142 cases were assessed for the study purpose during the 1 year study period. 183 cases were excluded from the study as per the exclusion criteria. Table-1 displays the basic characters of the study population. 287 (29%) children were belong to less than 2 years of age. 320 (33.4%) children were in the age group of 2-5 years. Remaining 352 (36.7%) children belong to 5-12years of age group. Sex incidence analysis shows that 536 (55.9%) were males and 423 (44.1%) were females in the study group. Complete haemogram revealed W.B.C count was normal (between 4000 to 11000) in 65% (623) of children. The W.B.C count was abnormal in remaining 35% (336) of children. In 49.8% (478) of children haemoglobin status was normal and the remaining 50.2% (481) of children were anemic. 60% (575) of hospitalized children have received either oral or pareneteral antibiotics as per the unit's protocol. 40% (384) of the children were treated without antibiotics.

Figure 1 displays the type of the antibiotic and its frequency of use in our study group. Ceftriaxone is the most commonly used antibiotic in our study group. Nearly one third (32.7%) of cases have received intravenous ceftriaxone among the antibiotics received group of children. Nearly 90 of the prescription was contributed by cephalosporin, penicillin group (ampicillin, amoxycillin and amoxycillin-clavulunate) and azithromycin among the antibiotic group.

Antibiotics used among various age groups, gender, laboratory parameters like total count, haemoglobin status and the system of involvement based on the final diagnosis were analyzed (Table 2). Based on the final diagnosis children in the study group were divided into 3 groups. Group -1 (must required, eg, cellulitis, abcess, pyogenic meningitis, acute dysentery) children belong to the category where antibiotics are recommended due to the possibility of definite bacterial cause of the illness based on the final diagnosis. Group 2 (can be used, eg acute watery diarrhea, bronchopneumonia) children

belong to this category are the children with the final diagnosis suggestive of either bacterial or other microbial agent as causative agent for the illness.

Table 1: General information of the study participants (n = 959).

Characteristics	Frequency	Percentage
Age category in years		
< 2	287	29
2 - 5	320	33.4
>5	352	36.7
Gender		
Male	536	55.9
Female	423	44.1
Total WBC count status		
Normal	623	65
Abnormal	336	35
Haemoblobin status		
Normal	478	49.8
Mild anemia	234	24.4
Moderate anemia	231	24.1
Severe anemia	16	1.7
Antibiotic use		
Yes	575	60
No	384	40
Need of antibiotic use		
Definitely required	125	13
Can be required	370	38.6
Not required	464	48.4

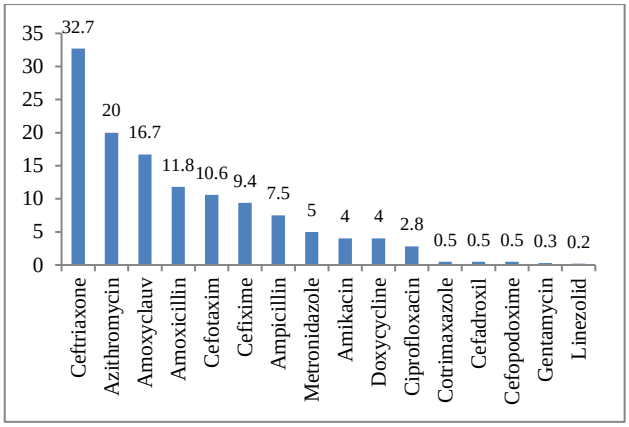

Figure 1: Profile of antibiotics used in any form among children admitted in paediatric ward (n = 575).

Group 3 (antibiotic not required eg. acute viral bronchiolitis, bronchial asthma) children presented with the final diagnosis suggestive of non-bacterial cause for their illness. Table 3 display the proportion of antibiotics used in children presented with different systemic form of illness. Out of 350 cases admitted with primary respiratory illness 70.1%. 248 children have received either oral or parenteral antibiotics. As per the final clinical diagnosis 46.6% 165 children were admitted for non-bacterial cause for their illness. Among the other major systemic illness children admitted as infectious disease and gastrointestinal disorders were 250 cases and 163 cases respectively.

Table 2: Factors associated with the use of antibiotics among study subjects (n = 959).

Characteristics	Antibiotic use		X^2 value, df[@]	p value[#]
	Yes n (%)	No n (%)		
Age in years				
< 2	167 (58.2)	120 (41.8)	6.67, 2	0.03*
2 - 5	210 (65.6)	110 (34.4)		
> 5	198 (56.3)	154 (43.8)		
Gender				
Male	327 (61)	209 (39)	0.55, 1	0.45
Female	248 (58.6)	175 (41.4)		
Total WBC count				
Normal	359 (57.6)	264 (42.4)	4.03, 1	0.04*
Abnormal	216 (64.3)	120 (35.7)		
Haemoglobin status				
Normal	259 (54.2)	219 (45.8)	13.23, 1	<0.001*
Anemia	316 (65.7)	165 (34.3)		
System of illness				
Respiratory	248 (70.1)	106 (29.9)	102.5, 6	<0.001*
Gastro-intestinal	73 (44.8)	90 (55.2)		
Infectious diseases	179 (71.6)	71 (28.4)		
Central nervous system	23 (31.5)	50 (68.5)		
Cardio vascular	9 (26.5)	25 (73.5)		
Renal	21 (80.8)	5 (19.2)		
Others	22 (37.3)	37 (62.7)		

Note: # p value based on Chi-square test; @ degrees of freedom; * Statistically significant (p <0.05)

Table 3: Requirement of usage and actual usage of antibiotic among children admitted with various system of illness (n = 959).

System of illness	Total	Must required	Can be required	Not required	Used out of total cases
Respiratory	354	10 (2.8)	179 (50.6)	165 (46.6)	248 (70.1)
Gastro-intestinal	163	15 (9.2)	101 (62)	47 (28.8)	73 (44.8)
Infectious diseases	250	88 (35.2)	15 (6)	147 (58.8)	179 (71.6)
Central nervous system	73	0	29 (39.7)	44 (60.3)	23 (31.5)
Cardio vascular	34	2 (5.9)	5 (14.7)	27 (79.4)	9 (26.5)
Renal	26	6 (23.1)	20 (76.9)	0	21 (80.8)
Others	59	4 (6.8)	21 (35.6)	34 (57.6)	22 (37.3)

Figures in the parenthesis are row percentages out of total cases against each system.

Out of these cases 179 (71.6%) and 73 (44.8%) children have received antibiotics and the number of cases with non-bacterial cause as final diagnosis was 147 (58.8%) and 47 (28.8%) respectively.

DISCUSSION

As per the W.H.O recommendations surveillance system is needed in every country to assess the antibiotic use by experts in clinical practice at local as well as at national level. Antibiotics overuse is well documented in developed countries. This study was undertaken to document the appropriateness of antibiotic use in pediatric practice. Monitoring antibiotic use as well as prevalence of resistant strains identification is essential in every hospital.[4] Out of 959 patients included in our study 60% (575) of the children have received antimicrobial agents. The type and proportion of antibiotic use in a centre depends upon the nature of cases admitted in the particular centre. As per the W.H.O target guidelines released during the year 2006 prescription rate of drugs to be reduced by 2%, 30%and 20% for the no of drugs, no of antibiotics and injections per encounter respectively.[6] As per the W.H.O recommendations the ideal prescription rate if antibiotic use in clinical practice has to be less than 30%. In a study done by Sharma et al at Georgetown the percentage of antibiotic prescription was 36.9 percent.[7] Whereas this figure varies from country to country (Sudan (81.3%), Nigeria (71.1%), and India (81.1%).[8-10] The antibiotic usage is high in developing countries and very high in economically disadvantaged regions. The antibiotic use depends on the various factors like availability of culture facility to identify or exclude the microbial organisms.[11] In children admitted with the diagnosis as infectious cause even if antibiotic was started initially it can be withdrawn once bacterial agents were excluded.

Microorganisms that show resistance are called as superbugs. Basically, there are 2 reasons for the development of resistance, prevalence of resistant genes among the microbes and misuse as well as overuse of antimicrobials in various fields.[12] Antimicrobial resistance occurs naturally over a period of time. But this is accelerated by overuse of antibiotics not only in human beings but also in other areas like veterinary practice, in agriculture and in the environment.[13] The antimicrobial resistance is seen in all the countries across the globe.[13] The antibiotics prescription rates vary markedly among the developing and developed countries. The antimicrobial resistance seen not only with bacteria it is seen with all categories of microbes (viral, rickettsial, chlamydial, fungal and parasites).[14] Increase in global trade and movement of the people can lead to transfer of resistant organisms across the globe. Surveillance of antimicrobial use and documentation of resistant organisms has to be done in all the countries by the health care experts.[15]

In clinical practice with certain common clinical diagnosis like acute respiratory illness, acute diarrheal illness due to the similarity of the symptoms in bacterial and viral agents' clinician depend on investigations support to justify the use of antimicrobial agents. So there are chances for the use of more antibiotics if the patients are not affordable for specific investigations, if the culturing facilities are not available or if the standard guidelines are ignored. In a study done by Bharathiraja et al in Chennai nearly 80% of children with acute respiratory infection and acute diarrheal disorders' have received antibiotic therapy.[5] Presence of fever is one of the reasons for starting antibiotic in their study. In our study group those children with clinical diagnosis suggestive of acute bacterial infection are the definite candidates for either oral or pareneral appropriate antibiotic therapy. (125) 13% of children belong to this category. When those conditions with the possibility of both viral and bacterial causes are added another 38.3% of cases may require antibiotics. By careful analysis and investigations support and using standard guidelines antimicrobial use can be restricted. In a study done by Xiayoun Liang in china the documented excess use of antibiotics in respiratory illness was 43%.[16] In a study done in Poland before and after the implementation of health care reforms they have found 50% reduction in the rate of antibiotic use in common clinical conditions like acute watery diarrhea.[17]

The pattern of antibiotic requirement will depend on the type of cases admitted in the centre. In our centre inj ceftriaxone is the antibiotic frequently used and it was prescribed among one third of the antibiotic group. This is similar to study done in Bangalore where the major

class of antibiotics used was cephalosporin group.[18] In a study done in Switzerland the inappropriate and overuse of antibiotic rate was 9-64%.[19] There are clear guidelines and indications for using broad spectrum antibiotics in clinical practice. Using narrow spectrum antibiotics as per indications will help to reserve the broad-spectrum antibiotics. Penicillin group is the predominant antibiotic used among the pediatric outpatients in the European countries.[2] Penicillin and extended spectrum of antibiotics are the common drugs used among the inpatients in European study.[14] In the study done in Jaffna 54% of children received antibiotics and penicillin group of the antibiotic was commonly used.[20] The prevalence of antibiotic resistance depends on the volume and pattern of antibiotic use. The treatment cost also will increase proportionately to the prevalence of antibiotic resistance.[21] Antimicrobials will not only destroy the pathogen also the commensals. These commensals also develop resistance and in turn transfer to pathogenic strains.[12] The hope of overcoming antibiotic resistance by newer antibiotic is diminished by the decline in rate of newer antibiotic discovery.[4]

System wise analysis have shown that out of children admitted for various types of respiratory illness and systemic infectious diseases 248 (70.1%) and 179 (71.6%) have received antibiotics respectively. In other studies, also respiratory system involvement is the predominant condition for hospitalization and antibiotic prescription in pediatric practice.[22] In a study done by Pennie et al as a prospective study respiratory cases were the predominant cases treated in the study group. 82.1% of children treated with antibiotic include acute otitis media, acute pharyngitis and acute bronchitis.[23] Among the infectious diseases viral infections are also given antibiotics both in developed and developing countries. The overuse of antibiotic is due to clinical uncertainty. In young children it is often due to overlap of symptoms.[24] Judicious use of antimicrobial use is the key to succeed antimicrobial resistance.[15] In our study systemic infections and children with respiratory infections are more in the antibiotic group. When the investigations do not identify any bacterial etiology and the child is not acutely ill antimicrobial can be withdrawn.[25]

CONCLUSION

The overuse of antimicrobials needs to be limited or reduced in human medicine, veterinary medicine, agriculture, and aquaculture. Ideally, the use of antimicrobials in agriculture should be eliminated. Documentation of need for antibiotic will justify its use in clinical practice. Intensive programs to educate both patients and physicians in reducing antimicrobial overuse should be implemented

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