Original Article

Impact of Educational Intervention on Rational Antibiotic Use In Pediatric Ward

***Dr. Makarand Dharma*[1], *Dr. Sachin Vahadane*[2], *Dr. Shreya Bhate*[3], *Dr. Abhijit Shinde*[1]**

[1]Assistant Professor, [2]Assocaite Professor, [3]Resident, Department of Paediatrics, DVVPF's Medical College & Hospital, Ahmednagar-414111, Maharashtra, India

Abstract:

Introduction: Introduction: Antibiotics are a class of natural and synthetic compounds that inhibit the growth of or kill other microorganisms. Overuse of antibiotic is one of the most important factors for the development and spread of resistance in the hospital, as well as in the community. Present study was designed to describe antibiotic use in children and to assess the impact of an educational intervention on antibiotic prescription. **Methodology:** The present study was conducted in pediatric ward of a tertiary care institute. The study population included two groups of children – each having 250 children. The first group consisted of 250 consecutive children admitted in one unit of the pediatric ward and they were analyzed for antibiotic use without any prior priming of the members of the unit regarding rationality of antibiotic use. This was followed by an intervention in the form of a 3hour workshop for all members of the unit. The second group included another 250 children consecutively admitted in the wards after this intervention. **Results:** In Pre intervention group 55 (44%) children received antibiotics in rational way, while in Post intervention group 90(60.40%) children received antibiotic in rational way. One hundred and thirty-six children (49.4%) received antibiotics for respiratory tract infections, this being the commonest disease for which antibiotics were received. As seen in the table, unindicated use of antibiotic was significantly reduced in Post intervention group ($p = 0.03$). **Conclusion:** The present study included 500 children. There were 285 (57%) males and 215 (43%) females. Amongst these 500 patients, 178 (35.6%) were below 1 year of age. This group had the highest number of patients. In the Pre intervention group, 55 (44%) children received antibiotics rationally, while in Post intervention group 90(60.40%) children received antibiotic rationally.

Keywords: Educational intervention, Rational antibiotic use, Antimicrobials

Introduction:

Antibiotics are a class of natural and synthetic compounds that inhibit the growth of or kill other microorganisms. These are among the most frequently prescribed medications in modern medicine. The use of antibiotics has contributed to the dramatic fall in morbidity from communicable and infectious diseases over the last 50 years globally. Overuse of antibiotic is one of the most important factors for the development and spread of resistance in the hospital, as well as in the community. Antibiotic resistance among common pathogenic bacteria in communities has been identified as an emerging threat to public health.[1] The Centers for Disease Control and Prevention (CDC) has identified drug-resistant organisms as a particular threat, and has recommended increased surveillance, risk factor identification, and promotion of judicious antibiotic prescribing.[2]

From a clinical standpoint, there are three principal concerns surrounding the use and management of antimicrobial drugs:

Corresponding Author: *Dr. Sachin Vahadane*

Email ID: *docsachinrv@gmail.com*

Address: *Department of Paediatrics, DVVPF's Medical College & Hospital, Ahmednagar-414111, Maharashtra, India*

ISSN No. *: (p) 2348-523X, (o) 2454-1982*

DOI: 10.46858/vimshsj.8305

Date of Published : *25th September 2021*

1. They are necessary for treatment of most bacterial infections. If they are not available in hospital pharmacies, lives may be jeopardized.
2. They may be prescribed inappropriately by physicians and drug sellers and especially by the general public (self-prescribing) over the counter.
3. Adverse drug reactions (ADRs) constitute the third critical area of antimicrobial drug use.

Such reactions include nephrotoxicity and allergic reactions as well as antibiotic associated diarrhea. It is estimated that 25 percent of ADRs are caused by antimicrobial drugs. It is recommended that hospitals must ensure availability of antimicrobial drugs while at the same time controlling and improving prescribing practices of physicians and minimizing untoward side effects.[3]

Inappropriate use of antibiotics is common in pediatric practice, and effective interventions are needed to promote judicious antibiotic use and reduce antibiotic resistance. It is unlikely that a single intervention will result in a dramatic, sustained drop in antibiotic use for children. Rather, a more gradual change in prescribing rates resulting from continued focus on patient education and physician behavior change may be the best long-term solution to the problem of antibiotic overuse. Clearly inappropriate indications such as cold, upper respiratory tract infection, and bronchitis accounted for smaller fractions of antibiotic use but may be most amenable to change. However, interventions that encourage use of strict criteria for diagnosis and treatment of common infectious illnesses in children will likely have the greatest impact on overall antibiotic use.

Three major approaches to improve antibiotic use are educational, managerial, and regulatory intervention.[4] Educational intervention includes CME-groups, work-shops, audit and feedback. Monitoring defined populations longitudinally will allow assessment of the effectiveness of such national and local initiatives.

One tool to address this problem is the elaboration of therapeutic and prophylactic protocols developed by examining each hospital's most prevalent infections, together with the local rate of bacterial resistance.

The WHO conference on the rational use of drugs in 1985 marked the beginning of efforts to improve the use of drugs, especially in developing countries.[5]

Present study was designed to describe antibiotic use in children and to assess the impact of an educational intervention on antibiotic prescription.

Methodology:

The present study was conducted in pediatric ward of a tertiary care institute. The study population included two groups of children – each having 250 children. The first group consisted of 250 consecutive children admitted in one unit of the pediatric ward and they were analyzed for antibiotic use without any prior priming of the members of the unit regarding rationality of antibiotic use. This was followed by an intervention in the form of a 3 hour workshop for all members of the unit. The second group included another 250 children consecutively admitted in the wards after this intervention.

Details of history and examination were recorded in a pre-designed proforma. It included presenting complaints, vital parameters and general and systemic examination findings at the time of admission. Investigations done were recorded.

Children who received antibiotics were evaluated further based on certain drug use indicators as shown below.[6]

Drug Use indicators

Indicator 1: Percentage of hospitalizations with one or more antimicrobial drugs prescribed

Indicator 2: Average number of antimicrobial drugs prescribed per hospitalization with antimicrobial drugs prescribed

Indicator 3: Average cost of antimicrobial drugs prescribed per hospitalization with antimicrobial drugs prescribed

Indicator 4: Route of antimicrobial administration

Indicator 5: Mean duration of hospital stay of patients who receive antimicrobial drugs

Indicator 6: Number of various culture tests reported per hospital admission including antimicrobial treatment

Antibiotics were divided into 1st line, 2nd line and 3rd line to assess rationality based on the spectrum used.

1st line Antibiotic	2nd line Antibiotic	3rd line Antibiotic
Ampicillin	Cefotaxime	Vancomycin
Chloramphenicol	Ceftriaxone	Piperacillin-Tazobactum
Gentamicin	Amikacin	Cefipime
Amoxicillin	Amoxicillin – clavulinic acid	Meropenam
Crystalline Penicillin	Ciprofloxacin	

Further assessment for rationality was based on the nature, extent and severity of disease state and seniors' evaluation. Antibiotic use was said to be rational if the diagnosis warranted antibiotic use and correct drug was used for optimum duration with regards to patient's age and diagnosis.

Antibiotic use was said to be irrational if it was unindicated and/or wrong drug was selected considering patient's age and diagnosis, if duration was not appropriate, wrong combination was used or more antibiotics were used than indicated.

The intervention program, as mentioned earlier was planned after the initial 250 children were enrolled. This was in the form of an interactive session. The members of the unit (treating physicians) were motivated regarding correct uses of antibiotics and hazards of their inappropriate use. Presenting features and basic investigations for diagnosis of common infectious illness like Bronchiolitis, Bronchopneumonia, Meningitis etc. were discussed.

Results:

Table 1: Age and sex wise distribution of the study children

Age	Pre intervention group		Post intervention group		Total
	Males No. (%)	Females No. (%)	Males No. (%)	Females No. (%)	
1 month - 1 year	55 (33.1)	9 (10.2)	41 (29.5)	57 (53.3)	178
1 - 3 year	40 (24.1)	24 (27.3)	33 (23.7)	11 (10.3)	108
3 - 6 year	22 (13.2)	19 (21.6)	35 (25.2)	20 (18.7)	96
6 - 9 year	31 (18.7)	11 (12.5)	19 (13.7)	9 (8.4)	70
9 - 12 year	18 (10.9)	9 (10.2)	11 (7.9)	10 (9.3)	48
Total	166	88	139	107	500

Chart 1

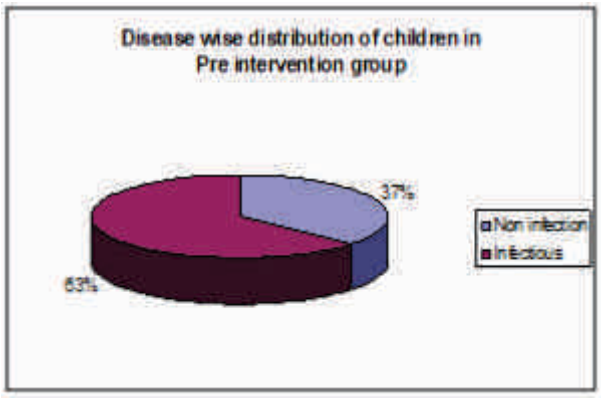


Chart 2

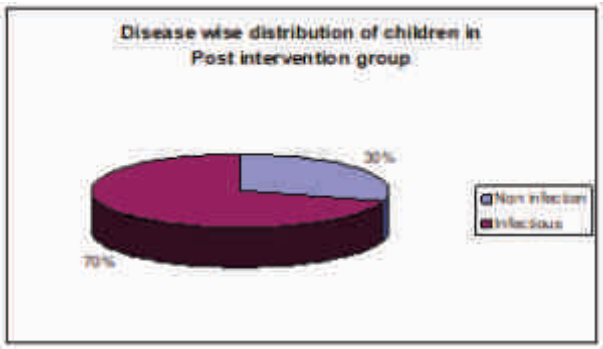


Table 2: Number of children who received antibiotics

Groups	Antibiotics received No. (%)	Antibiotics not received No. (%)	Total
Pre intervention group	125 (50)	125 (50)	250
Post intervention group	149 (59.6)	101 (40.4)	250
Total	274 (54.8)	226 (45.2)	500

Table 3: Number of antibiotics received by children

No of antibiotics	Pre intervention group No. (%)	Post intervention group No. (%)	Total
One antibiotic	89(71.2)	105 (70.5)	194
Two antibiotic	20 (16.0)	24 (16.1)	44
Three antibiotic	11 (8.8)	12 (8.0)	23
Four antibiotic	5 (4.0)	4 (2.7)	9
Five antibiotic	0 (0)	3 (2.0)	3
Six antibiotic	0 (0)	1 (0.7)	1
Total	**125**	**149**	**274**

Table 4: Disease wise distribution with Rationality of antibiotic use

Diseases	Pre intervention group		Post intervention group		Total
	Indicated	Unindicated	Indicated	Unindicated	
Respiratory tract infections	49	11	70	6	136
Gastroenteritis	8	7	14	5	29
Bacillary dysentery	2	0	4	0	6
Urinary tract infection	8	0	7	0	15
Meningitis	3	0	1	0	4
Leptospirosis	0	0	4	0	3
Dengue	0	5	0	1	6
Enteric fever	4	0	3	0	7
Viral fever	0	3	0	4	10
Others	18	1	23	3	38
Total	**98**	**27***	**130**	**19***	**274**

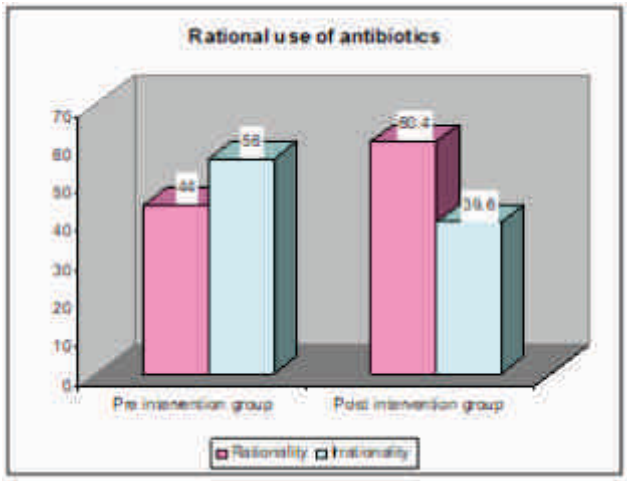
As seen in the table, unindicated use of antibiotic was significantly reduced in Post intervention group (p = 0.03).

Table 5: Rational use of antibiotics

	Rationality No. (%)	Irrationality No. (%)	Total
Pre intervention group	55(44.0)*	70(56.0)	125
Post intervention group	90(60.4)*	59 (39.6)	149
Total	**145**	**129**	**274**

*P=0.007

Chart 3



Discussions:

Antibiotics are among the most frequently prescribed medications in modern medicine. The World Health Organization has established antibiotic use as a priority in its campaign for the rational use of medications.[6] Antibiotics account for a significant proportion of total hospital drug expenditures. Furthermore, it is estimated that 50% of all physician orders for antibiotics are for the wrong drug, or an inappropriate dosage or duration. In addition, inadequate antibiotic use increases costs by increasing the length of stay in the hospital.[7, 8]

This study has brought out many interesting aspects in the issues of antimicrobial prescriptions and has addressed whether a single one time educational intervention has any impact on the pattern of prescriptions amongst resident doctors. On analyzing our findings, we could reach to some meaningful conclusions which are described in detail.

Table 1 shows age and sex wise distribution of 500 children included in the study. Of these 285 (57%) were males and 215 (43%) were females. Amongst these 500 patients, 178 (35.6%) were below 1 year of age. This group had the highest number of patients. The youngest child was 1 month old and the oldest was 12 years old. The male to female ratio was 1.8:1 in pre intervention group, while it was 1.2:1 in post intervention group. The discrepancy in the ratio of male to female could not be avoided as the study design demanded an inclusion of consecutive admissions in the wards, which could not be controlled.

When looking at the various illnesses that these children were suffering from for which they were hospitalized, it was found that 151 children [60.4%] in the pre intervention group and 162 children [64.8%] in the post intervention group were admitted for infectious illnesses (Table 2). Ninety nine (39.6%) in Pre intervention group and 88 (35.2%) children in Post intervention group were diagnosed to have non infectious diseases. Thus, infectious illnesses accounted for almost two-thirds of the admissions to pediatric ward. Campbell J et al[9] noted similar observations. They reported infectious diseases as the primary cause of hospitalization among children. In another study by G'Mariam A et al[10] diagnosed infectious illnesses in 61.3% of children admitted to pediatric ward. In a study by Accorsi et al[11], infectious diseases accounted for 7 of the 10 leading causes of pediatric admissions.

As seen in various studies antimicrobial drugs are the most frequently prescribed therapeutic agents, accounting for 30 to 50 percent of drug prescriptions.[12] In the present study, 274 [54.80%] patients received antibiotics, 50% in pre intervention group and 59% in post intervention group, as seen in Table 4. This figure is similar to the 55.4% prevalence of antibiotic use, as described by Fonseca L et al.[13] The use of antibiotics was as high as 69.9% in a study described by Shankar P et al.[14] They have studied prescribing patterns among pediatric inpatients in a teaching hospital in western Nepal.[14]

As opposed to these high figures, in a study conducted in The Netherlands by van Kasteren M et al[15], antibiotic use was much lower at about 30%. These data suggest that the rate of antibiotic use among hospitalized patients in developing countries is relatively higher than in the developed ones. Table 5 demonstrates disease wise distribution of children who received antibiotics. One hundred and thirty-six children (49.4%) received antibiotics for respiratory tract infections, this being the commonest disease for which antibiotics were received. These included 60 children (48%) from the pre intervention group and 76 (52%) in the post intervention group. Ten [3.6%] children had viral fever and they were treated with antibiotics. Similar observation was noted by Fonseca L et al[16] who found that amongst children who received antibiotics, the incidence of respiratory tract infection was 49.5% and gastroenteritis was 11%; antibiotic prescriptions for viral illnesses in the study accounted for 9.2%.This is in contrast with the results of Jonathan A et al[17] who reported Otitis media (62.1%) accounting for the majority of antibiotic prescriptions.

Antimicrobial control measures are commonly perceived to lead to an improvement in quality of prescribing, cost-effectiveness and reduction in resistance. Table 5 gives an idea about changes in practice of antibiotic use, following an interventional educational program. In the pre intervention group, 55 (44%) children received antibiotics rationally, while in post intervention group 90(60.40%) children received antibiotic rationally. Change in the rational use of antibiotic was statistically highly significant (p = 0.007). Santis G et al[18] have reported similar observations of improved antibiotic prescription after an educational campaign. Prescriptions consistent with recommendations in the guidelines increased from 60.5% before the campaign to 87.7% afterwards. Similarly an educational program comprising information feedback and antibiotic usage guidelines was effective in improving antibiotic use at a tertiary care university hospital in Thailand as described by Thamlikitkul et al.[19] A targeted educational intervention can improve antibiotic prescription practices for respiratory infections in children and decrease unnecessary antibiotic use as reported by another worker.[18] Contrary to this, Doyne E et al[20], has shown academic detailing appeared to be no more effective in reducing antibiotic use.

Conclusion:

From this study it is clear that addition of educational intervention on rational antibiotic use in pediatric ward helped pediatrician to change antibiotics rationally. To conclude it can be stated that inappropriate use of antibiotics is increasing and is responsible for rapidly developing antimicrobial resistance. We believe that it is unlikely that a single intervention will result in a dramatic, sustained drop in antibiotic use for children. Rather, a more gradual change in prescribing rates resulting from continued focus on patient education and physician behavior change may be the best long-term solution to the problem of antibiotic overuse.

References:

1. Tenover FC, Hughes JM. The challenges of emerging infectious diseases: development and spread of multiply-resistant bacterial pathogens. Jama. 1996 Jan 24;275(4):300-4.
2. Jernigan DB, Cetron MS, Breiman RF. Minimizing the impact of drug-resistant Streptococcus pneumoniae (DRSP): a strategy from the DRSP working group. Jama. 1996 Jan 17;275(3):206-9.
3. Liss RH, Batchelor FR. Economic Evaluations of Antibiotic Use and Resistance: A Perspective: Report of Task Force 6. Reviews of infectious Diseases. 1987 May 1:S297-312.
4. Ostini R, Hegney D, Jackson C, Williamson M, Mackson JM, Gurman K, Hall W, Tett SE. Systematic review of interventions to improve prescribing. Annals of Pharmacotherapy. 2009 Mar;43(3):502-13.
5. Laing R, Waning B, Gray A, Ford N, Hoen ET. 25 years of the WHO essential medicines lists: progress and challenges. The Lancet. 2003 May 17;361(9370):1723-9.

6.How to Investigate Antimicrobial Drug Use in Hospitals Selected Indicators Working Draft May 2001Draft published for the U.S. Agency for International Development by the Rational Pharmaceutical Management Plus Program.Arlington,VA: Management Sciences for Health.

7.Ena J. Optimal use of antibiotics. In: Wenzel, R.P.Prevention and control of nosocomial infection 3rd ed. Baltimore: Williams & Wilkins, 1997.

8.Kunin CM. Resistance to antimicrobial drugs—a worldwide calamity. Annals of internal medicine. 1993 Apr 1;118(7):557-61.

9.Campbell JD, Sow SO, Levine MM, Kotloff KL. The causes of hospital admission and death among children in Bamako, Mali. Journal of tropical pediatrics. 2004 Jun 1;50(3):158-63.

10.G'Mariam A. A two year retrospective review of reasons for pediatric admission to Chiro Hospital, Eastern Ethiopia. Ethiopian Medical Journal. 2005 Jan 1;43(4):241-9.

11.Lett RR, Kobusingye OC, Ekwaru P. Burden of injury during the complex political emergency in northern Uganda. Canadian Journal of surgery. 2006 Feb;49(1):51. Verhoef J

12. Surveillance of antibiotic resistance. Curr Opin Infect Dis. 1999 Aug;12(4):321-6.

13.Fonseca LG, Conterno LD. Audit of antibiotic use in a Brazilian University Hospital. Brazilian Journal of Infectious Diseases. 2004;8:272-80.

14.Shankar PR, Mishra P, Subish P, Upadhyay DK. Can drug utilization help in promoting the more rational use of medicine? Experiences from Western Nepal. Pak J Pharm Sci. 2007 Jul 1;20(3):243-8.

15.Van Kasteren ME, Kullberg BJ, De Boer AS, Mintjes-de Groot J, Gyssens IC. Adherence to local hospital guidelines for surgical antimicrobial prophylaxis: a multicentre audit in Dutch hospitals. Journal of Antimicrobial Chemotherapy. 2003 Jun 1;51(6):1389-96.

16.Arnold SR, Straus SE. Interventions to improve antibiotic prescribing practices in ambulatory care. Cochrane database of systematic reviews. 2005(4).

17.Finkelstein JA, Davis RL, Dowell SF, Metlay JP, Soumerai SB, Rifas-Shiman SL, Higham M, Miller Z, Miroshnik I, Pedan A, Platt R. Reducing antibiotic use in children: a randomized trial in 12 practices. Pediatrics. 2001 Jul 1;108(1):1-7.

18.Razon Y, Ashkenazi S, Cohen A, Hering E, Amzel S, Babilsky H, Bahir A, Gazala E, Levy I. Effect of educational intervention on antibiotic prescription practices for upper respiratory infections in children: a multicentre study. Journal of antimicrobial chemotherapy. 2005 Nov 1;56(5):937-40.

19.Thamlikitkul V, Danchaivijitr S, Kongpattanakul S, Ckokloikaew S. Impact of an educational program on antibiotic use in a tertiary care hospital in a developing country. Journal of clinical epidemiology. 1998 Sep 1;51(9):773-8.

20.Burstein VR, Trajano RP, Kravitz RL, Bell RA, Vora D, May LS. Communication interventions to promote the public's awareness of antibiotics: a systematic review. BMC Public Health. 2019 Dec;19(1):1-1.