Journal of Applied Pharmaceutical Science 01 (06); 2011: 220-222

Journal of Applied Pharmaceutical Science

Available online at www.japsonline.com

ISSN: 2231-3354
Received on: 11-08-2011
Revised on: 16-08-2011
Accepted on: 19-08-2011

Changes in daily defined doses (DDD) of antibiotics after restricted use in medical inpatients

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ABSTRACT

Drug Use Evaluation of Antibiotics was studied in medical inpatients after regulation of its use. The total quantity of antibiotics consumed were analyzed using Defined Daily Doses(DDDs) technique. Significant differences were observed in DDDs before and after the regulation. The study proved that evaluation of antibiotic utilization improved the appropriate and effective use of antibiotics and is economical to the patient.

Key words: Antibiotics, Inpatients, Regulations, Quantity consumed, DDDs.

INTRODUCTION

Antibiotics are powerful and effective drugs in the fight against infectious diseases caused by bacteria and have been frequently used for decades worldwide for effective treatment of a variety of bacterial infections. (Paterson, 2006). Antibiotics have saved millions of lives since their first appearance about fifty years ago. Yet, more and more people are dying from infectious disease that were curable but for which we no longer have the right treatment. This is because certain bacteria are transforming themselves and developing resistance to antibiotics. (Dickerson et al, 2000; Gyssens et al, 1997). The prime cause of rapid increase of resistant bacteria in both developing and developed countries is the abuse and inappropriate use of antibiotics. [1] In addition to bacterial resistance to antibiotics, it has given rise to an increased risk of side effects, drug toxicity, and makes the treatment more expensive. One of the possible measures to reduce the inappropriate use is the rationalization. (Feely , et al, 1990; Goldman et al, 1996; Quick et al, 1991). The Defined Daily Dose (DDD) is the assumed average maintenance dose per day for a drug used for its main indication in adults. (Natsch et al, 1998) .The DDD is often a compromise based on a review of the available information about doses used in various countries. (Filius , et al ,2005) .The DDD may even be a dose that is rarely prescribed because it is an average of two or more commonly used dose sizes. (Sommers et al ,2002). Drug utilization figures should preferably be presented as numbers of DDDs/1000 inhabitants/day or when in-hospital drug use is considered as DDDs per 100 Bed Days. For anti-infective or other drugs normally used in short periods, it is often considered most appropriate to present the figures as numbers of DDDs per inhabitants per year. (World Health Organization, 2002).

MATERIALS AND METHODS

All the patients admitted in the Department of General Medicine of a 1100 bedded tertiary care teaching hospital and research center in south India were served as the study population. The Department of General Medicine was selected for the reason that large numbers of patients were admitted and moreover most of them were treated with antibiotics.

The study was conducted for all the cases admitted during a period of two years. All the individual medical records were studied with respect to demographic data, indication for initiation of treatment, source of infection, period of stay in the hospital, number of medicines prescribed, number of antibiotics used, total doses of antibiotics consumed microbiological reports including bacterial identification, sensitivity as well as resistance towards the antibiotic prescribed.

As a fore- step of the study, a hospital drug formulary was prepared by the Pharmacy and Therapeutic Committee (PTC) in consultation with the heads of all departments. The primary objective of the formulary was to rationalize the use of drugs. As a result, the prescription order was reduced. Moreover, all the prescribed medicines were made available in the hospital pharmacy for the patients. It also provided information about the drugs available in the hospital pharmacy to all the health care professionals. Adherence to the hospital formulary was fully established during a span of one year. Intervention orders were issued regarding the regulation in antibiotic prescription thereby prescriptions of antibiotics were regulated.The data were collected from all the patients at the time of admission. Follow up was conducted on all days to find out the progress of the treatment. The total doses of antibiotics consumed the corresponding DDD were calculated. All the data were analyzed using chi-square test at 5% level of significance. All the differences were tested at $p<0.05$ (two-tailed).

RESULTS AND DISCUSSION

A total of 4897 cases before and 6765 cases after the intervention were studied. Out of 4897 patients admitted before the regulation, 2375 (48.5%) patients were treated with antibiotics but after implementing the regulation on the antibiotic prescription, the study showed that out of 6765 patients admitted, 2425 (35.8 %) received antibiotics. This result showed that there was a significant reduction in the number of patients receiving antibiotics. This effect can be attributed to the strict monitoring of antibiotic use and improved patient care.

The number of antibiotics consumed before and after the interventions were 16554 and 14445 respectively. The total number of doses of antibiotics consumed by all patients in the ward were 53311 and 44351 before and after the intervention respectively. The study had shown a significant reduction in the total number of doses of antibiotics (16.8%) as well as the number of antibiotics (12.7%) consumed. These can decrease the risk of drug interactions, error of prescribing and non-compliances.

The total doses of antibiotics consumed before and after the regulation were calculated and were technically quantified using an international measure-Defined Daily Doses per 100 Bed Days (DDD per 100 BD, Table-1)

Table 1. Summary of Daily Defined Doses per 100 Bed Days.

Antibiotics	DDD/100BD	
	Before Regulation	After Regulation
Aminoglycosides	1.82	1.41
Broad Spectrum Antibiotics	0.56	0.01
Carbapenams	1.36	0.81
Cephalosporin-First Generations	0.34	0.63
Cephalosporin-Second Generations	4.00	1.83
Cephalosporin-Third Generations	24.5	14.48
Cephalosporin-Fourth Generations	0.27	0.07
Extended Spectrum Penicillins	16.36	25.76
Fluroquinolones First Generations	2.70	4.30
Fluroquinolone-Second Generations	5.89	4.65
Glycopeptides	0.46	0.26
Imidazole Derivatives	0.07	0.03
Lincosamide + Cephalosporin-Third Generation	0.34	0.20
Lincosamides	1.33	0.50
Macrolides	4.97	9.92
Oxazolidinones	0.16	0.08
Penicillins	1.98	1.78
Sulphonamide and Trimethoprim	0.34	0.22
Uredopenicillins	1.30	1.27

P-values calculated using unpaired t-test (two tailed, a = 0.05).

A 22.52% (1.82 to 1.41DDD/100BD) reduction in the use of aminoglycoside was observed. This was mainly attributed to the reduction in the use of Amikacin and Gentamycin. The broad spectrum antibiotic used during the study period was Chloramphenicol which get reduced by 98.2 %(0.56 to 0.01 DDD/100BD).

During the pre regulation period cephalosporins were commonly prescribed. Among them third generation cephalosporins were the most commonly prescribed antibiotic (42.3%). After the restriction, this was decreased by 40.89 % (24.5 to 14.48 DDD/100 BD). This was mainly due to the reduction in the use of intravenous ceftriaxone which itself was reduced by 35.87%. The prescription of second generation cephalosporin also reduced by 54.25 %(4.0 to 1.83DDD/100 BD). The restriction in the intravenous administration of cefuroxime was the main reason for this decrease. The reduction in the use of second and third generation cephalosporins led to an increase in the use of first generation cephalosporins. Correspondingly the prescriptions for the first generation cephalosporins were increased by 85.29 % (0.34 to0.63DDD/100BD). This was mainly due to increased administration of Cephalexin and Cefazolin. The use of carbapenams was decreased by 40.44 % (1.36 to 0.81DDD/100 BD) due to restricted prescription of imipenam and meropenam injections which were the most expensive antibiotics used.

The use of extended spectrum antibiotic was increased by 57.45 % (16.36 to 25.76 DDD/100 BD). Amoxicillin was the most commonly used drug of choice before and after the restricted use for URTI particularly for sinusitis. But increase in the resistance against this drug caused an increase in the use of amoxicillin with clavulanate and also ampicillin.

Use of macrolid antibiotics increased by 99.59 %(4.97 to 9.92 DDD/100 BD) mainly due to the increased use of Azithromycin used for the treatment of bronchitis. These increase in the use of extended spectrum penicillins and macrolids showed that they were found to be sensitive enough to treat the infections.
Use of first generation fluoroquinlones were increased by 59.25 % (2.7 to 4.3 DDD/100 BD) mainly due to the increased use of Ciprofloxacin and Ofloxacin. The consumption of the second generation fluroquinolones did not alter much indicating regulation on its use in entrobacteriae infection

Use of Lincosamide was reduced by 62.40 % (1.33 to 0.5 DDD/100BD). Lincosamide and its combination with third generation cephalosporin (Ceftriaxone) were also decreased(0.34 to 0.2 DDD/100BD). Only one drug belonging to oxazolidinone category (Linezolid) was administered and their use was reduced to 50 % (0.16 to 0.08DDD/100BD). A reduction in the consumption of Sulphonamides, Penicillin and imidazole derivatives were observed after the interventions justifying the rational use. The use of Piperacillin (uredopenicillins) did not alter much after the restricted use as the drug was the drug of choice for advanced pneumonia.

CONCLUSION

Antibiotic use is an area where physician can coordinate with a multidisciplinary team including other health professionals such as pharmacist and microbiologist for assuring optimum drug use. The Monitoring systems and interventions have been reported to be useful in improving the quality of healthcare. A combination of more than one intervention is more useful in the rationalization of the antibiotics. The present study proved that evaluation of antibiotic utilization improved the appropriate and effective use of antibiotics and is economical to the patient.

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