ORIGINAL ARTICLE

Drug Utilization Evaluation of Antibiotics in a Multispecialty Hospital

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ABSTRACT

Introduction: The objective of the study was to evaluate the drug utilization evaluation of antibiotics in a multispecialty hospital. A retrospective study was carried out at Vivekananda Medical Care Hospital, Tiruchengode.

Materials and Methods: The study was analyzed using the National Treatment Guidelines for antimicrobial use in infectious disease in 2016. All inpatients prescribed with antibiotics were analyzed for the utilization pattern of antibiotics. Two hundred and five prescriptions containing antibiotics were analyzed. A total of 383 antibiotics were identified from all the prescription. In this, 50.73% was given as empirical therapy and 49.26% as definitive therapy.

Results: Ceftriaxone (79.78%) was the widely prescribed antibiotic. Culture sensitivity test was done only in 101 (49.26%) prescriptions. *Escherichia coli* was the major infectious organism. From 101 culture-positive patients, 65 (64.35%) patients had undergone de-escalation. During the study period, drug-related problems such as drug interaction, medication error, and drug duplication were identified.

Conclusion: Antibiotics were widely prescribed in all the departments of the multispecialty hospital of study. The status of antibiotic prescribing pattern in this hospital was analyzed. Without a proper antibiotic policy, it will never be possible to reduce the irrational use of such important drugs. Regular prescription auditing along with implementation of standard protocol can only improve the current situations.

Key words: Antibiotics, antimicrobial resistance, sensitivity, utilization

INTRODUCTION

Antimicrobial agents provide some of the most dramatic examples of the advances of modern medicine.[1] Antibiotic, a subcategory of antimicrobials is the chemical substance of microbial origin that possesses the property of inhibiting the growth or killing of other microorganisms.[2]

Various generations of antibiotics that are used commonly are experiencing resistance from many organisms. The precise national scenario of antimicrobial resistance (AMR) is not known in India due to the absence of a central monitoring agency.[3] A mixture of determinants as increasing livelihoods, uncontrolled access to antibiotics, including over-the-counter sale as well as the sale without a prescription or with an invalid prescription; and unorthodox economic incentives for the physician to prescribe antibiotics, often powered by patient request and anticipation – has played a major role in the emergence of AMR in India. The emergence of carbapenem resistance, particularly carbapenem-resistant *Enterobacteriaceae*, has been a major concern in developed countries, especially in the hospital/healthcare setting. Even though only mild increase in carbapenem-resistant strains of *Escherichia coli* has been reported in India, there has been a much larger increase in carbapenem-resistant strains of *Klebsiella pneumonia*.

India is one among the country ranked with the highest rate of bacterial infections. A multicentric study carried out in seven tertiary care hospitals in Indian cities found that extended-spectrum beta-lactamase producers comprised 61% of *E. coli*. About 31–51% *Klebsiella* species were resistant to carbapenem followed by 65% *Pseudomonas* sp. Most of the microorganisms were resistant to ceftazidime and 42% resistant to imipenem. The salient decrement in resistance against former antimicrobials, which are not used very regularly, implies the prospect of inverting the AMR tide if indiscriminate antibiotic consumption can be restrained.[4]

Antimicrobial de-escalation is an effective antimicrobial stewardship program executed when a broad-spectrum antibiotic is given initially, in the absence of multidrug-resistant organism and when multiple antibiotics are given. It eliminates the inadequacy of empirical therapy.[5] The antimicrobial regimen should be reviewed regularly for the possible de-escalation to ward off the emergence of resistance, to lower toxicity, to cut down costs, and to lessen the prospect that the patient will evolve superinfection with other resistant organisms such as *Candida* species, clostridium difficile, or vancomycin-resistant *Enterococcus faecium*.[6]

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Drug utilization evaluation is an ongoing, systematic, principle-based program of medicine evaluations that will help provide appropriate medicine utilization.[7] Antimicrobial prophylaxis should be limited to specific, well-accepted indications even though its use has led to the prevention of a large number and variety of infections and to substantial declines in surgical site infections.[8]

The aim of this study was to evaluate the drug utilization evaluation of antibiotics in a multispecialty hospital.

Table 1: Demographic details of patients

Gender	Number of patients (%)
Male	112 (54.63)
Female	93 (45.36)

Table 2: Department-wise analysis of prescription

Departments	Number of cases (%)
General	73 (35.61)
Orthopaedics	31 (15.12)
Urology	23 (11.21)
Cardiology	21 (10.24)
Pulmonology	19 (9.26)
Gastroenterology	17 (8.29)
Nephrology	14 (6.82)
Emergency	3 (1.46)
Gynaecology	2 (0.97)
Neurology	2 (0.97)

Table 3: Class-wise distribution of antibiotics

Group	Number of antibiotics (%)
Cephalosporins	183 (47.78)
Fluoroquinolones	54 (14.09)
Aminoglycosides	46 (12.01)
Penicillins	42 (10.96)
Carbapenem	11 (2.87)
Nitroimidazoles	10 (2.61)
Oxazolidinone	10 (2.61)
Tetracyclines	6 (1.55)
Lincosamide antibiotics	5 (1.3)
Macrolide antibiotics	4 (1.04)
Nitrofuran	3 (0.78)
Azole derivatives	2 (0.52)
Glycopeptide antibiotics	2 (0.52)
Polymyxin derivatives	2 (0.52)
Topical antibiotics	2 (0.52)
Sulfamethoxazole+Trimethoprim	1 (0.26)

MATERIALS AND METHODS

Retrospective drug utilization evaluation was done using the medical records of private hospital and the ethical clearance was approved by Vivekanandha Medical Care Hospital, and the study was carried out during January 2019–June 2019 for 6 months period of time. A total of 205 patients were included in the study, after getting the patient consent and the required data were collected in specially designed data entry form. The study was included with both the genders and inpatients with complete medical information in the case sheet were included in the study. Moreover, mainly patients with at least one antibiotic in the prescription must be included in the study. Incomplete information and patients without proper medical information were excluded from the study. Moreover, finally, percentage calculation data were analyzed using Microsoft Excel software.

RESULTS

From the 205 prescription records, 54.63% of patients were male and 45.36% were female. Patients in the age between 61 and 70 years (28.78%) were most predominantly prescribed with an antibiotic followed by 22.43% (46 patients) of 51 and 60 years and 13.17% (27 patients) of 41 and 50 years of age, respectively. The mean age was found to be 45.4 years, as shown in Table 1.

The cases were analyzed and the highest number of antimicrobial prescription was obtained from the general medicine department 35.61% (73 cases), followed by

Table 4: Distribution of cephalosporin

Cephalosporins	Drug name	Number	Total	Percentage
First generation	-	0	0	0
Second generation	Cefuroxime 250 mg	32	37	20.21
	Cefpodoxime 200 mg	05		
Third generation	Ceftriaxone 1 g	74	146	79.78
	Cefixime 100 mg	41		
	Cefoperazone 250 mg+sulbactam 1 g	23		
	Cefotaxime 1 g	08		
Fourth generation	-	0	0	0

orthopedics department 15.12% (31cases) and 11.21% (23 cases) from urology department, as shown in Table 2.

Among 383 prescribed antibiotics, the most frequently used antibiotics were cephalosporins 47.78% (183 patients), fluoroquinolones 14.09% (54 patients), penicillins 10.96% (42patients), and aminoglycosides 12.01% (46 patients), as mentioned in Table 3.

Utilization pattern of cephalosporin revealed that the third- and second-generation cephalosporin were widely prescribed containing 79.78% (146) and 20.21% (37) of total 183 cephalosporin drugs. Considering the use of penicillin antibiotics, piperacillin + tazobactam 73.8% (31 cases) was prescribed more often by the physicians followed by amoxicillin + clavulanic acid 21.42% (9 cases) and penicillin G 4.65%. The fourth-generation fluoroquinolones 53.57% (30) stood as the highly prescribed antibiotic of the total 55 fluoroquinolones prescribed and it was followed by the second-generation antibiotics which formed 28.57% (16). Monoantibiotics therapy contained 28.29% of fixed-dose combinations (FDCs), of which piperacillin + tazobactam was 44.82% (26 drugs) which was highly prescribed followed by cefoperazone + sulbactam was 29.31% (17 drugs). Dual therapy with FDC constituted 8.78% of total prescription (205). These prescriptions had amoxicillin + clavulanic acid, cefoperazone + sulbactam, and piperacillin + tazobactam 27.77% as the widely used drugs, as mentioned in Tables 4-6.

The culture sensitivity reports were obtained only in 101 cases (49.26%) and in the remaining 104 cases (50.73%), specimens were not sent for culture and sensitivity testing. Infections were highly caused by Gram-negative organisms 81.42% (57 prescriptions) followed by Gram-positive organisms 18.57% (13 prescriptions). The most commonly isolated organisms were *E. coli* (30 prescriptions), *Klebsiella* sp. (13 prescriptions), and *Pseudomonas aeruginosa* (7 prescriptions). In 104 prescriptions, antibiotics were used as empirical therapy 50.73% (104 cases) and the remaining were given as definitive therapy 49.26% (101), as listed in Table 7.

Table 5: Utilization of penicillin class of antibiotics

Penicillins	Number of patients (%)
Piperacillin+tazobactam 2.25 g	31 (73.8)
Amoxicillin+clavulanic acid 500 mg	9 (21.42)
Penicillin G 5 million units	2 (4.65)

DISCUSSION

In this retrospective observational study, 205 prescriptions collected from various departments over a period of 6 months were analyzed to evaluate the pattern of antibiotic utilization. Out of 205 cases studied, the gender categorization had revealed that 54.63% were male (112) patients and 45.36% were female (93). In a similar study conducted in 2015 noted the predominance of male patients with 57% and 43% of female patients in a total of 512 prescriptions studied.[5]

In our study, most patients were aged between 61 and 70 years (28.78%). About 35.61% (73 patients) of hospital admission were referred by the department of general medicine followed by 15.12% (31 patients) by orthopedics and drug utilization evaluation of antibiotics in a multispecialty hospital 11.21% (23 patients) by the department of urology. Among all 383 antibiotics were used for a total of 205 patients. The highest group of antibiotics prescribed was the third-generation cephalosporin comprising 47.78%, 14.09% of fluoroquinolones, 12.01% of aminoglycosides, and 10.96% of penicillins. Among cephalosporins, the most frequently prescribed antibiotic was ceftriaxone. In 2017 study, cephalosporins 28.23%, penicillin 23.56%, and nitroimidazoles 19.95% were the three highly prescribed antibiotic classes.[8]

Culture sensitivity test was done only in 49.26% (n = 101) of the total prescriptions and the remaining 50.73% (n = 104) of prescriptions were without the support of bacteriological basis. Infections caused by Gram-negative organisms were 81.42% (n = 57) and 18.57% (n = 13) were caused by Gram-positive organisms. This organism increases the mortality rate of patients. This trend was similar to that observed in 2018 study with the evaluation of antimicrobial utilization pattern.[9] *E. coli* comprising 44.28% (31 isolates) was the most frequently isolated microorganism followed by *Klebsiella* species 18.5% (13 isolates) and *Pseudomonas aeruginosa* 10% (7 isolates). This trend was similar to that observed in investigation

Table 6: Commonly prescribed fluoroquinolones (n=205)

Generations	Drug name	Number of drugs	Total	Percentage
First generation	-	0	0	0
Second generation	Norfloxacin 400 mg	3	16	28.57
	Ciprofloxacin 500 mg	4		
	Ofloxacin 200 mg	9		
Third generation	Levofloxacin 250 mg	9	9	17.85
Fourth generation	Moxifloxacin 250 mg	30	30	53.57

Table 7: Microorganisms identified in culture report (*n*=205)

Microorganism	Number of prescription (%)
Escherichia coli	31 (44.28)
Klebsiella	8 (11.42)
Pseudomonas aeruginosa	7 (10)
Klebsiella pneumonia	5 (5.71)
Enterococcus faecalis	5 (7.13)
Staphylococcus aureus	3 (4.28)
Streptococcus pyogenes	3 (4.28)
Staphylococcus epidermidis	1 (1.42)
Candida species	1 (1.42)
Acinetobacter pittii	1 (1.42)
Enterobacteriaceae	1 (42)
Shigella flexneri	1 (1.42)
Acinetobacter junii	1 (1.42)
Escherichia coli	1 (1.42)
Staphylococcus haemolyticus	1 (1.42)

of antimicrobial use at a tertiary care hospital (2017).[10] Antibiotic agents in 104 (50.73%) prescriptions were used as empirical therapy and in 101 (49.26%) prescriptions were definitive therapy. This trend was similar to that observed in 2017 study with 1239 study subjects where in *E. coli* was isolated in 20 cases, *K. pneumonia* in 6 cases followed by *Enterococcus faecalis* in 5 cases.[11]

CONCLUSION

The rational and proper uses of antibiotic are a greatest need of the current situation all over the world. It identified the status of antibiotic prescribing pattern in a multispecialty hospital. This study has shown that antibiotics are widely prescribed in all the departments of the multispecialty hospital of study.

Antibiotics were given empirically in slightly more number of cases in comparison to definitive therapy. This study clearly highlights the practice of multiple antibiotic therapies and it has to be controlled by the use of empirical antibiotic policy. Clinical pharmacists and clinicians need to play a key role in minimizing the antibiotic problems by conducting continual awareness programs regarding up-to-date prescribing guidelines in the hospital, and documentation of pharmacist observation on prescription inpatient folder is highly recommended for safety and drug monitoring.

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