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ANALYZING PRESCRIPTION AND SENSITIVITY PATTERN TO MAKE INSTITUTIONAL ANTIBIOTIC POLICY

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ABSTRACT
The optimal antibiotic control measures are essential and they vary between institutions. Various control measures implemented have helped in reducing the cost of treatment and quantity of drugs prescribed without compromising in the quality of care. The main objective of this work is to frame an antibiotic policy of medical institution based on the analysis of the antibiotic prescribing pattern and culture sensitivity reports. The antibiotic prescriptions were collected from various departments for a period of four months and complied manually. The sensitivity reports were collected from the microbiology laboratory excel sheets. Further it was investigated for the correlation between laboratory results and antibiotic prescriptions. Statistical analysis using SPSS and Spi info software were used. The results highlighted that scheduled reduction of intensively used antibiotics may be effective in reversing increased resistance in the hospital setting and limit the spread of multiresistant clones. The sensitivity pattern data obtained from the microbiology laboratory and prescriptions were not correlated. Hence, it is essential to frame an antibiotic policy for hospital setting to prevent the development of antibiotic resistance and to delay the spread of resistant strains.

KEYWORDS: Microbiology sensitivity report, prescription patterns, Institutional policy.

INTRODUCTION
In developing Countries like India, the cost of drugs including antibiotics is a major concern to medical health care professionals and patients. It has been seen that the investments and expenditures for antibiotics account for nearly 50% of a hospital's total drug budget[1,2]. Extensive mistreatment of antimicrobial drugs has been reported in the past few years and nearly half of all antibiotic drug prescriptions have been found to be poorly selected. This is especially true for the general wards in tertiary medical centers where errors in prescription, administration and delivery are common. In such scenarios, the possibility of drug interactions and adverse drug reactions are high, as large numbers of medications are prescribed. Additionally, inappropriate and unreasonable utilization of antimicrobials can cause microbial resistance to the commonly-prescribed antimicrobials[3]. This, in turn, can contribute to the use of newer, more costly antibiotics to fight the crisis of microbial resistance[2]. This is an issue of great concern to a developing country like India.

Analysis of drug prescription practices is of special interest with respect to increasing costs of health service. The prescribing pattern can be evaluated in a retrospect manner through analysis of clinical records in a medical care center[4]. The study of prescription pattern is generally a part of a medical audit that looks for appraisal, and if required, modification, in prescription pattern, to obtain rational and cost-effective medical care[5]. Globally, patients in the ICU have encountered an increasing emergence and spread of antibiotic-resistant pathogens. The worldwide incidence rate is 23.7% infections per 1000 patients. Rates of nosocomial infections range from 5% to 30% among ICU patients. Although ICUs generally comprise <5% of all hospital beds, they account for 20% to 25% of all nosocomial infections[6]. The increased risk of infection is associated with the severity of the patient's illness, length of exposure to invasive devices and procedures, increased patient contact with healthcare personnel and length of stay in the ICU[7].

The irrational use of drugs including improper indication, dosage, duration, combination and associated instruction results in increased incidence of resistance to commonly used antibiotics and increased expenditure on healthcare. It is estimated that almost one-third of the hospitalized patients receive antibiotics, half of which is unnecessary[8,9]. Review of the antimicrobial agent utilization in the tertiary medical centers and information about the various strains of microorganisms and their sensitivity patterns are helpful in developing infection control plans in the tertiary medical centers[4]. Development of resistant microorganisms due to inappropriate use of antibiotics can result in the spread of these microorganisms to other patients admitted in the same ward[10]. Hence, prevention of inappropriate antibiotics use is vital for infection control plans in the tertiary medical centers.

In India, there have been few studies of antibiotic use, especially in identifying the comparison of microbiological antibiotic sensitivity report with prescription patterns. Therefore, the objective of this study was to determine the antibiotic sensitivity reports obtained from the department of Microbiology and compared the data with prescription pattern in tertiary care teaching hospital, Perambalur, India.

MATERIALS AND METHODS

Antibiotic sensitivity analysis

Antimicrobial susceptibility tests can guide the physician in drug choice and dosage to treat infections. Results are commonly reported as the minimal inhibitory concentration (MIC), which is the lowest concentration of drug that inhibits the growth of the organism. Reports typically contain a quantitative result in µg/mL and a qualitative interpretation. The interpretation usually categorizes each result as susceptible (S), intermediate (I), resistant (R), sensitive dose dependent (SD) and/or no interpretation (NI)[11]. These data were interpreted in the excel sheet of Clinical Microbiology department and that are collected and kept as initial data for comparative analysis with prescription pattern of the antibiotics.

Prescription pattern

The prescriptions of the antibiotics to the patients who are diseased with various infections were collected from all clinical departments for a span of four months (December 2014 to March 2015) and were compiled manually. The inpatient and outpatient section of all departments have an electronic or manual record in the case sheet[12,13]. This may be collected from the department itself or from medical record department (MRD).

Comparative analysis

Perceived lack of resources and uncertainty with respect to both diagnostic and treatment decisions frequently influenced decision making[14]. The spatial and temporal prescribing patterns of antibiotics written in the prescriptions were compared with the sensitivity patterns of the report obtained from Microbiology laboratory for the same patients[15]. Therefore the successful validation study strongly depends on the correlation of the antibiotic sensitive to the test bacterial strains reported from the lab with the antibiotic prescribed by the clinicians. This study is based on correlating the above data and deriving the antibiotic resistance levels.

Statistics

SPSS was used for this descriptive analysis. To identify predictors for antibiotic prescription, we performed two multilevel logistic regressions modeling in STATA with antibiotic prescription and broad-spectrum prescribing respectively as the dependent variable. The level of statistical significance was set to 0.05. Further, EPI info and Microsoft excel softwares for various analyses including bar diagram etc. the resistance percentages were calculated manually. The study was approved by the institutional ethical committee and permission obtained from all departments concerned.

RESULTS

This study provides encouraging results which suggest that scheduled reduction of intensively used antibiotics may be effective in reversing increased resistance in the hospital setting and limit the spread of multi resistant clones. On the whole amikacin produces 33% of resistance, out of 308 cases, 102 proved to be resistant which accounts for about 1/3rd cases (Table 1).

Table 1: Resistance rate and prescription pattern of Amikacin

Department	% resistance	No. of prescriptions	No of cases with chances of resistance
ENT	33	1	0.3
General Medicine	32	13	5
General Surgery	49	89	44
OBG	26	39	10
Orthopedics	63	132	83
Pediatrics	15	34	5

The resistant rate of various antibiotics are analyzed and compared thereby cefotaxin showed maximum resistance (68%) followed by ciprofloxacin (66%) and doxycycline (66%). The detailed resistance pattern, sensitivity data and prescription patterns of other routine antibiotics utilized in the clinical practice are compared and depicted in table 2.

Table 2: Comparativeness of resistance and sensitivity pattern of various antibiotics with prescriptions

Antibiotic	% resistance	% sensitive	No. of prescriptions	No. of cases showed resistant	No. of cases showed sensitive
Ciprofloxacin	66	34	310	204	106
Cefotaxim	68	32	1809	1230	579
Doxycycline	66	34	75	50	25
Gentamycin	56	44	44	25	19
Levofloxacin	58	42	18	10	8
Ofloxacin	65	35	182	118	64
Tetracycline	64	36	3	2	1

The resistance pattern and prescription patterns of antibiotics used in various clinical departments were well analyzed and compared. In the division of General Medicine, the prescription of cefotaxim and ofloxacin are high (n=68) compared with other antibiotics eventhough the resistance pattern is high. The descriptive analysis of the prescription and resistance pattern of antibiotic used in general medicine was impregnated in figure 1.

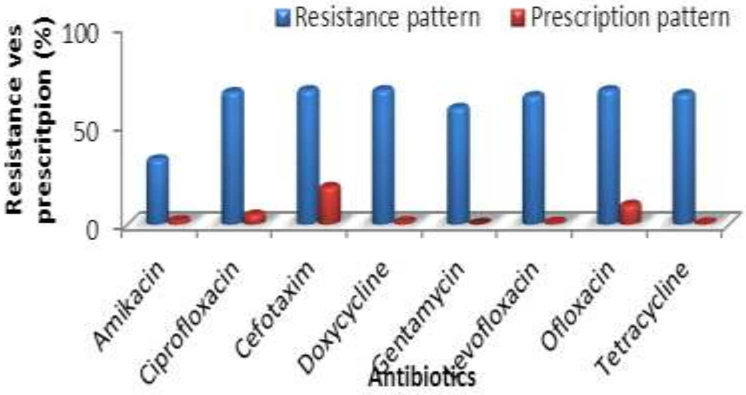

Figure 1: Comparativeness of prescription vs resistance of antibiotics in General Medicine

In General surgery, the resistance pattern was high in Ofloxacin followed by cefotaxim and prescription pattern was found high in cefotaxim. The prescriptions of other antibiotics are less and may be used in emergency conditions or before the lab reports observed. The figure 2 highlighted the comparativeness of resistance and prescription of various antibiotics in the unit of General surgery.

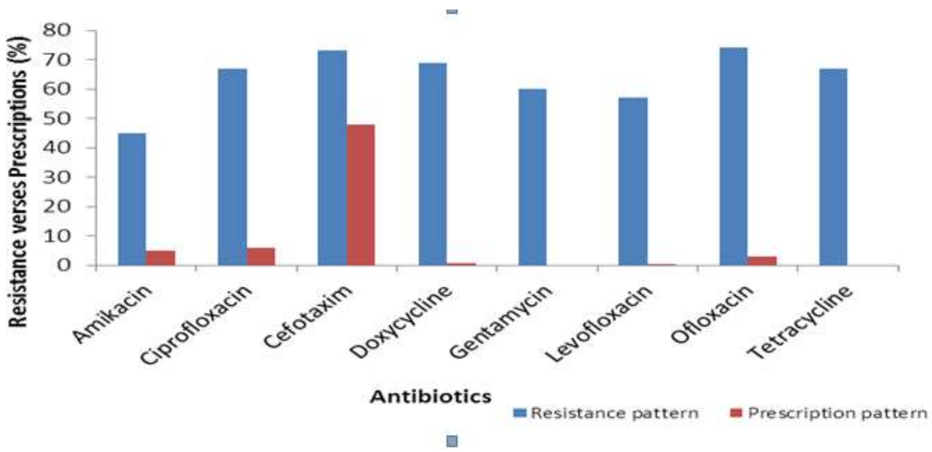

Figure 2: Comparativeness of prescription vs resistance of antibiotics in General Surgery

In Obstetrics and Gynecology unit, the resistance pattern of various antibiotics were determined and compared thereby ciprofloxacin and cefotaxim showed maximum resistance with 66% followed by doxycycline (61%). Further, the prescription pattern was compared with the resistance indicated cefotaxim is used in high level when showed more resistance (Figure 3).

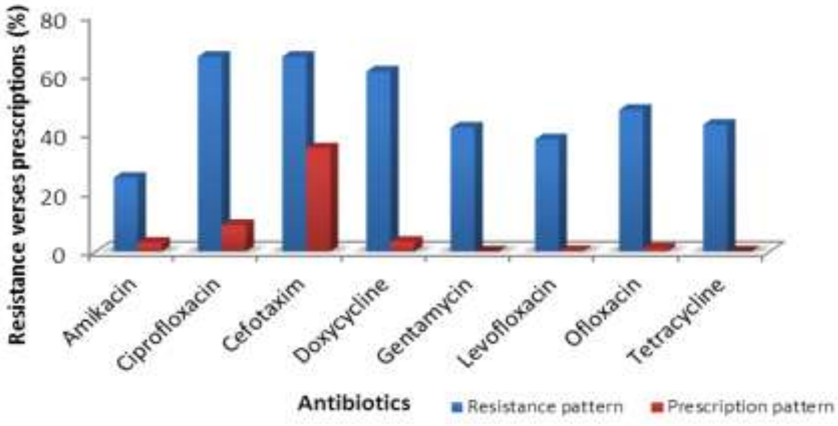

Figure 3: Comparativeness of prescription vs resistance of antibiotics in Obstetrics and Gynecology unit

The prescription pattern and resistance pattern in Pediatrics was observed nearing equal by using the antibiotics cefotaxim found 46% and 67% respectively. The resistance pattern was observed high in tetracycline (70%) followed by cefotaxim and ciprofloxacin; while in prescription pattern next to cefotaxim, amikacin found more (Figure 4).

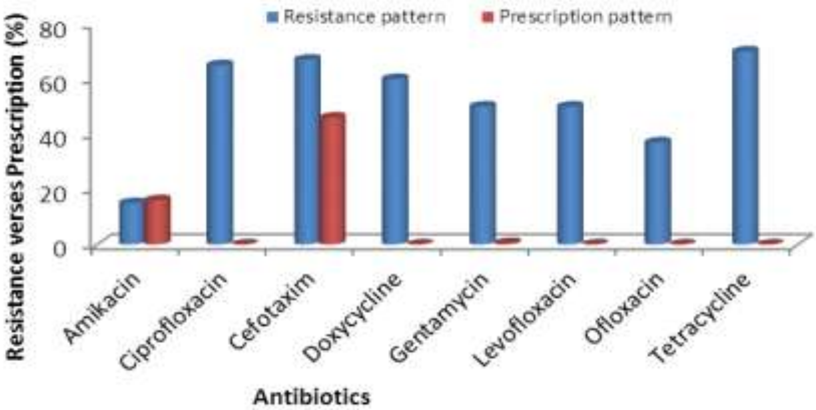

Figure 4: Comparativeness of prescription vs resistance of antibiotics in Pediatrics unit

In the Orthopedics ward, the resistance pattern was high in tetracycline (88%) followed by Ofloxacin (75%), cefotaxim (71%); the same percentage (63%) was found in amikacin, ciprofloxacin and gentamycin. But the prescription pattern data was controversy while it was found more in cefotaxin followed by amikacin (Figure 5).

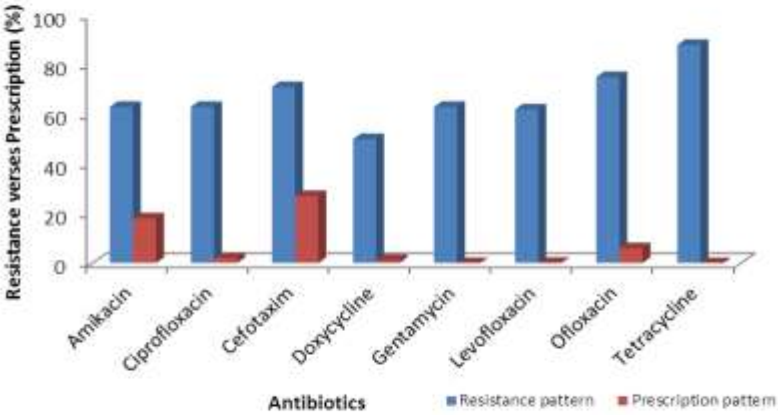

Figure 5: Comparativeness of prescription vs resistance of antibiotics in Orthopedics unit

Overall, on comparing with other clinical units Orthopedics showed maximum resistance followed by general surgery. The prescription pattern also correlated with some drugs like cefotaxime, ciprofloxacin, tetracycline etc.

DISCUSSION

Antibiotic resistance among pathogenic microorganisms is a matter of worldwide concern. Selective pressure by antimicrobial drugs is by far the most important driving force for the development of such resistance. Antibiotics are among the most commonly prescribed drugs in hospitals and in developed countries around 30% of the hospitalized patients are treated with these drugs[16,17]. The present study documents that 29.5% of the patients were prescribed antibiotics. This is very similar to the reports from developed countries[16]. Antibiotic prescription was studied over 3 months, the major disadvantage being that seasonal variations in antibiotic prescribing could not be taken into consideration over this short period. The number of samples which were sent for culture and sensitivity testing were small which may also affect the validity of the conclusions drawn about antibiotic resistance[17].

Healthcare assocaited anti-biograms can be a useful means for guiding empiric therapy and tracking the emergence of resistance among bacterial isolates, as it is shown in the present study. Similar study also suggested on antibiotic susceptibility pattern of rapidly growing mycobacterium[18]. Out of the 148 rapidly growing mycobacterium isolates, 146 (98%) were susceptible to Amikacin, 138 (91%) to Gatifloxacin, 132 (87%) to Moxifloxacin, 122 (76%) to ciprofloxacin, and 116 (74%) to Norfloxacin. The prevalence and antimicrobial susceptibility pattern of Methicillin-Resistant *Staphylococcus aureus* (MRSA) and Methicillin-Resistant Coagulase-Negative Staphylococci (MRCoNS), out of the total 350 staphylococcal isolates from different clinical specimens, 148 isolates (60.40%) were identified as MRSA and 46 isolates (43.80%) were screened as MRCoNS[19].

All isolates of MRSA and MRCoNS were multi-drug resistant. Antibiotic resistance pattern of these isolates was high against penicillin, whereas all the MRSA strains were resistant to penicillin and oxacillin (100%). The MRCoNS strains also showed closely similar drug resistance pattern with 97.82% isolates being resistant to penicillin. However, all the MRSA and MRCoNS isolates were uniformly susceptible to vancomycin. Chloramphenicol and rifampicin also showed excellent activity against methicillin-resistant isolates. This study indicated a high level prevalence of MRSA and MRCoNS strains resistance against widely used antimicrobial agents. A study on prevalence of antibiotic resistance of the commensal flora in Dutch nursing homes is related to this present work with high resistance and prescription correlations. [20,21].

The resistance and intermediate susceptibility of *E. coli* varied from 4% (ceftriaxone) to 43% (amoxicillin). Extended spectrum β-lactamase producing Enterobacteriaceae were found in 6% of the patients. Amoxicillin and/or co-amoxiclav users were significantly more resistant to these antibiotics (69%) than non-users (38%). Antibiotic use was associated with antibiotic resistance of *E. coli*[21]. To overcome this issue, continuous surveillance of susceptibility testing is necessary for cost effective customization of empiric antibiotic therapy. Furthermore, reliable statistics on antibiotic resistance and policies that are mandatory to control spread of resistant pathogens should be made available. Clinical pharmacists play a significant role in promoting optimal antibiotic prescribing practice among physicians, during their routine visit toward.

CONCLUSION

The antibiotic prescribing pattern and the corresponding sensitivity and resistance data have been successfully analyzed. It is proven that there is a raise in the antibiotic resistance percentage. It is clearly evident that more resistant antibiotics are being prescribed for larger number of cases. It is made clear that an antibiotic policy is essential to tackle the raise in antibiotic resistance. It shows that there must be an Antibiotic surveillance every year and the antibiotic policy must be altered accordingly.

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