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Prescribing patterns of antibiotics and sensitivity patterns of common microorganisms in the Surgery ward of a teaching hospital

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Abstract
Background: The widespread and often inappropriate use of antimicrobial agents is the single most important cause of the emergence of drug resistance, both in the community and hospital settings. The irrational prescribing of medicine results in serious morbidity and mortality and also lead to reduction in the quality of treatment; thereby causing wastage of resources, increased treatment cost, increased risk for adverse drug reaction, and emergence of resistance. This study was carried out to collect relevant demographic information, antibiotic prescribing patterns and common organisms isolated including their antibiotic sensitivity patterns so as to provide appropriate antimicrobial therapy to reduce the risk of proven or suspected bacterial infections and to prevent the emergence of resistant bacteria and to prevent the misuse of antimicrobials to decrease the cost involved and the emergence of antibiotic resistant bacteria.
Methods: This study was carried out over a 6 month period with the aim of identifying prescription pattern of antibiotics and evaluating the rational use of antibiotics in accordance with WHO prescribing indicators. 60 prescriptions were examined from the inpatient department of Surgery wards of Rajah Muthiah Medical College and Hospital (RMMCH), Chidambaram. The wards were visited twice a week. Each prescription was followed till the discharge date. The prescribing details from each prescription were recorded and the drug use patterns of antibiotics were examined. The antimicrobial sensitivity patterns of common organisms were determined and the suspected adverse drug events with antibiotic therapy during the study period were recorded. The data were analysed as per the WHO core drug use indicators.
Results: The result shows that 60 patients were prescribed antibiotics out of which 44 patients were male. 10 antibiotics were mostly prescribed and the most common ones were cefotaxime, metronidazole, ciprofloxacin, ceftriaxone and amikacin. Culture sensitivity tests were carried out in 30 patients. The common organisms isolated were *Escherichia coli, Staphylococcus aureus* and *Methicillin Resistant Staphylococcus aureus*.
Conclusions: Irrational use of drugs can lead to ineffective and unsafe treatment and exacerbation and prolongation of illness, distress and harm to the patients. Hence prescription audit is necessary and the Clinical Pharmacist interventional programs should focus on promoting infectious control with rational antibiotic prescription aimed at minimizing the future emergence of bacterial resistance. Multi-faceted interventions are suggested at many levels for the benefits of the community in the form of continued medical educational programs, consumer awareness and policy formation for hospital antibiotic use.

Keywords: rational prescribing, antibiotic prescribing

Introduction

Antibiotics are the substances produced by microorganisms, which selectively suppress the growth or kill other microorganisms at very low concentrations. Antibiotics are one of the pillars of modern medical care and play a major role both in the prophylaxis and treatment of infectious diseases. The issues of their availability, selection and proper use are of critical importance to the global community. The systematic approach to the selection of an appropriate antibiotic requires the following steps:

- Confirming the presence of infection by means of physical examination, medical history of patient and predisposing factors.
- Identifying the pathogen with the help of microbiological culture sensitivity tests.
- Selection of a presumptive therapy considering every infected site based on host factors and drug factors.
- If an antibiotic is indicated, the choice will depend on its efficacy, safety, price and potential for selection of resistant organisms.
- Finally, monitoring the therapeutic response by means of clinical assessment, laboratory tests and assessment of therapeutic failure.

The antibiotic selected should only cover the likely pathogens and should be given at correct time. The duration of therapy varies depending upon the nature of infection and the causative organism. The dosage should be high enough to ensure the efficacy and minimise the risk of resistance selection, and low enough to minimise the risk of dose related toxicity. Single agents should be used unless it has been proven that combination therapy is required to ensure efficacy

or reduce the selection of clinically significant resistance.

Antimicrobial resistance (AMR) is the ability of micro-organisms to find ways to evade the action of the drugs used to cure the infections they cause and is increasingly recognised as a global public health issue which could hamper the control of many infectious diseases. Some bacteria have developed mechanisms which render them resistant to many of the antibiotics normally used for their treatment (multi-drug resistant bacteria), so pose particular difficulties, as there may be few or no alternative options for therapy. They constitute a growing and global public health problem. WHO suggests that countries should be prepared to implement hospital infection control measures to limit the spread of multi-drug resistant strains and to reinforce national policy on prudent use of antibiotics, reducing the generation of antibiotic resistant bacteria? The widespread and often inappropriate use of antimicrobial agents is the single most important cause of the emergence of drug resistance, both in the community and hospital settings. Clearly, the emergence of antimicrobial resistance can be prevented or delayed through judicious prescribing.

An audit of antibiotic prescribing patterns is an important indicator of the quality and standard of clinical practice. The study of prescribing patterns is a part of medical audit and seeks to monitor, evaluate and if necessary, suggest modifications in prescribing practices to make medical care rational.

The objectives of the study were to

- Collect relevant demographic information and information on duration of hospitalization of patients admitted to the surgery ward and prescribed antibiotics during the study.
- Obtain information on the antibiotic prescribing pattern and the disease conditions for which it is prescribed.
- Obtain information on the common microorganisms isolated during culture and its sensitivity testing and their antibiotic sensitivity patterns.
- Analyse the prescribing and drug use patterns of antibiotics and their outcomes.

Methods

The study was carried out over a 6 month period at Rajah Muthiah Medical College and Hospital (RMMCH), Chidambaram. The patients admitted to the surgery wards who were prescribed with antibiotics were included in the study and were identified manually. The protocol approval was obtained from Institutional Human Ethics Committee and hospital authorities.

Totally, 60 prescriptions were examined from the inpatient wards of surgery units. The surgery wards were visited twice a week. Each prescription was followed till the discharge date. The relevant demographic information of the patient and their duration of hospitalization were entered in the data collection forms. The prescribing details of antibiotics from each prescription and the disease conditions for which they were prescribed were recorded data acquisition form and were tabulated. The organisms isolated during culture test and their antibiotic sensitivity patterns were also recorded.

The data were analyzed as per the WHO core drug use indicators. The most commonly occurring disease conditions for which antibiotics were prescribed in surgery wards were also analysed separately. The details of each prescription were analyzed by percentage calculation.

Results and Discussion

Demographics

A total of 60 patients were included in the study in which 44 (73.33%) were males and 16 (26.66%) were females. As age is one of the host factors to be considered in the selection of an antibiotic and is handled differently for patients at both extremes of age, it should be taken into account for study

Table 1

S/No	Age groups	Number of patients	Percentage
1	10-20	6	10%
2	21-30	5	8.33%
3	31-40	8	13.33%
4	41-50	13	21.66%
5	51-60	16	26.66%
6	61-70	8	13.33%
7	71-80	4	6.66%

The maximum number of patients enrolled in the study belonged to 51-60 years (26.66%) followed by the age group of 41-50 years (21.66%) and the least number of patients belonged to age group of 71-80 years (6.66%).

Assessment of distribution of various disease conditions in surgery wards

Majority of the cases seen in the wards were of hernia (26.66%) which were seen mostly in the age group of 41-50 years, then followed by appendicitis (23.33%) and were seen mostly in the age group of 11-20 years.

Table 2

S/No	Diagnosis	Number of cases	Percentage	Maximum number of cases w.r.t age groups
1	Intestinal Obstruction	3	5%	51-60
2	Gastritis	5	8.33%	41-50
3	Acute Pancreatitis	5	8.33%	Even
4	cellulitis	6	10%	51-60
5	appendicitis	14	23.33%	11-20
6	hernia	16	26.66%	41-50
7	diabetic foot ulcer	11	18.33%	51-60

Culture organisms isolated

Out of 30 bacterial cultures isolated, 11(36.66%) cultures were gram positive bacteria and 19 (63.33%) cultures were gram negative bacteria. The most frequent Gram positive isolate was *Staphylococcus aureus* (20%) followed by Methicillin Resistant *Staphylococcus aureus* (16.66%) and the most frequent gram negative isolate was *Escherichia coli* (40%) followed by *Pseudomonas* (13.33%) and *Klebsiella* (10%).

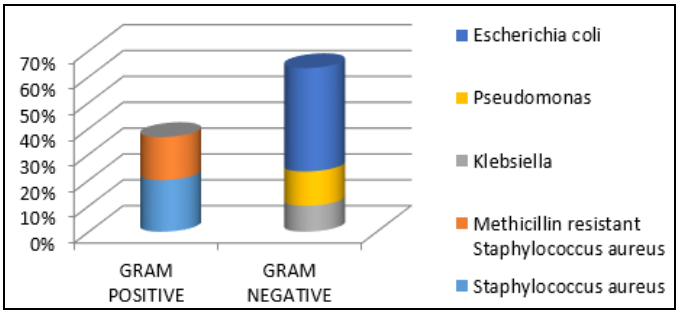

Fig 1

Antibiotic Sensitivity Patterns

- ***Staphylococcus aureus***

The isolates of *Staphylococcus aureus* were mostly susceptible to amikacin (83.33%) and chloramphenicol (100%) and were mostly resistant to both erythromycin and clindamycin (66.66%). They have also shown equivalent sensitivity and resistivity patterns to antibiotics like ciprofloxacin and gentamicin.

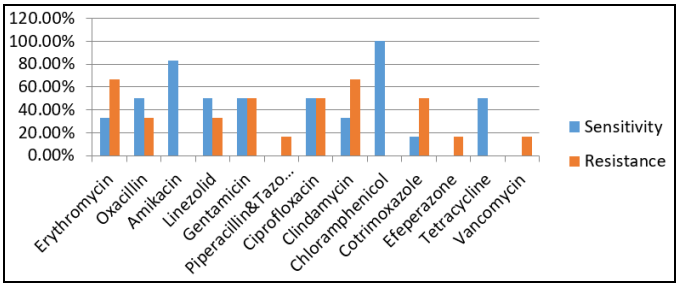

Fig 2

- ***Methicillin Resistant Staphylococcus aureus* (MRSA)**

The isolates of Methicillin resistant *Staphylococcus aureus* were highly sensitive to ciprofloxacin (100%), chloramphenicol and amikacin (both 80%) and moderately sensitive to erythromycin and clindamycin (both 60%). They have shown high resistance to oxacillin (100%), cotrimoxazole (80%) and moderate resistance to gentamicin (60%).

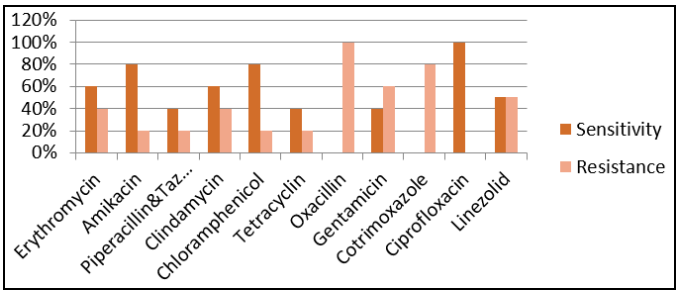

Fig 3

- ***Klebsiella***

The isolates of *Klebsiella* were completely susceptible to both amikacin and gentamicin (100%) and moderately susceptible to ciprofloxacin, cotrimoxazole and cefotaxime (all 66.66%). They were highly resistant to cefuroxime and nalidixic acid (both 100%) and moderately resistant to efeperazone, ceftriaxone, ampicillin and amoxicillin (66.66%).

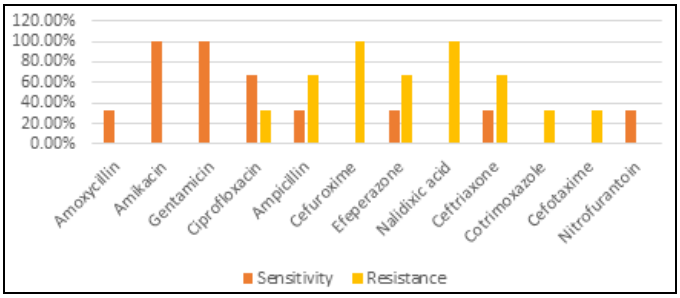

Fig 4

- ***Pseudomonas***

The isolates of *Pseudomonas* were highly susceptible to tobramycin (75%) and moderately susceptible to ceftriaxone, ciprofloxacin, ofloxacin, nalidixic acid, imipenem, gentamicin and amikacin (50%). The isolates were totally resistant to piperacillin & tazobactam.

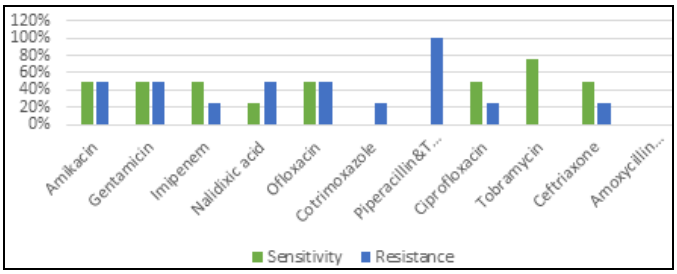

Fig 5

- ***Escherichia coli***

More than half of the isolates of *Escherichia coli* were susceptible to amikacin (66.66%) and ciprofloxacin (58.33%). Most of them were resistant to cefuroxime (91.66%) and more than half of them were resistant to cotrimoxazole and efeperazone (58.33%).

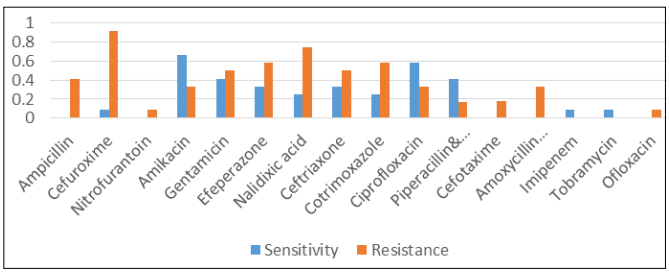

Fig 6

Type of Antibiotic regimen and therapy

35 of the patients were treated with a single antibiotic and the other 25 patients were treated with combination of 2 antibiotics (mainly cefotaxime+metronidazole).

Table 3

S.no	Types of antibiotic regimen	Number of cases
1.	Single Drug	35
2.	Two drug combination	25

Among 60 cases observed in the study, 38 cases were treated by empirical antibiotic therapy and 22 cases were treated definitive antibiotic therapy.

Table 4

S.no	Type of therapy	Number of cases	Percentage
1.	Empirical	38	63.33%
2.	Definitive	22	36.66%

Systemic route was the most selected route of administration and was administrated in 53 patients.

Table 5

S.no	Dosage form	Number of patients	Percentage
1.	Systemic (Injection)	53	88.33%
2.	Oral (Tablet)	7	11.66%

Antibiotics prescribed

The most commonly prescribed antibiotic in the surgery wards during the study period was cefotaxime (71%), followed by metronidazole (23.33%) and ciprofloxacin (16.66%).

Table 6

S.no	Antibiotics	Percentage
1.	Cefotaxime	71%
2.	Amoxycillin clavulanate	6.66%
3.	Piperacillin & Tazobactam	6.66%
4.	Ceftriaxone	11.66%
5.	Ciprofloxacin	16.66%
6.	Garamycin	5%
7.	Ofloxacin	8.33%
8.	Metronidazole	23.33%
9.	Amikacin	11.66%
10.	Gentamicin	3.33%

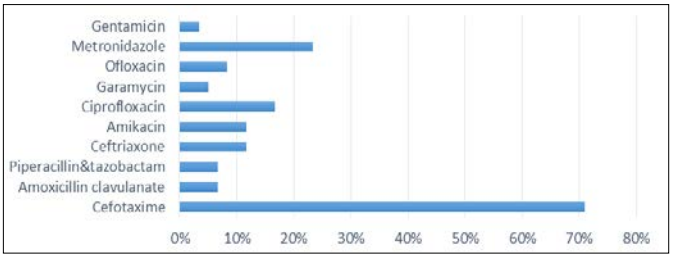

Fig 7

Conclusion

The high rate of prescription of parenteral antibiotics is a matter of concern. An intravenous to oral antibiotic conversion program can be instituted.

Quickening the availability of culture and sensitivity reports will enable the treatment to have a sound bacteriological basis and will promote definitive antibiotic therapy.

The prescribers are prescribing higher antibiotics rather than the lower antibiotics, though several antibiotic guidelines for the common inflammatory conditions recommend the use of lower antibiotics. The same broad spectrum antibiotic is used in most of the cases rather than using a specific antibiotic that can cover the likely pathogen or the bacteria is sensitive towards. This practice is not in well compliance with the accepted antibiotic guidelines.

Antibiotic resistance is becoming a problem and formulation of a hospital antibiotic use policy is a matter of urgent concern. An educational programme and an antibiotic order form may be useful initiatives to reduce antibiotic use.

Prevention and control of the spread of anti-biotic-resistant organisms will require increased adherence to basic infection control policies and procedures, incorporation of antimicrobial resistance strategies into institutional goals and development of a plan to deal with patients colonized with resistant organisms.

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