Study of Antimicrobials Use For Indoor Versus Outdoor Patients in Medicine Department At A Tertiary Care Hospital

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Abstract: This study was conducted to assess antimicrobials prescribing pattern in indoor and outdoor patients of medicine department. It was prospective, cross sectional, observational study. Data of first 1000 eligible consecutive case records during 3 months were considered. About 24% and 76% prescriptions were from indoor and outdoor patients respectively. Majority of indoor patients were from age group of 46-60 years whereas majority of outdoor patients were from age group of 31-45 years. Most frequently prescribed antimicrobial in indoor and outdoor patients was ceftriaxone injection (20.05%) and amoxicillin + clavulanic acid tablet (32.62%) respectively. Polypharmacy was observed in both groups. Parenteral antimicrobials were commonly prescribed in indoor patients (87.93%). Percentages of antimicrobials prescribed by brand names were 84.88% and 69.89% in indoor and outdoor patients respectively. More than 99% antimicrobial prescriptions of indoor and outdoor patients were from national list of essential medicines 2015. About 70% of antimicrobial prescriptions were rational. But maximum indoor prescriptions were made without microbial culture and sensitivity testing evidences (72.08%). Hence, they were not supported by hospital antibiotic policy. The number of antimicrobials prescribed by generic names was low in indoor patients and effort must be made to encourage prescribing by generic names.

Keywords: Antimicrobial prescription pattern, Drug utilization studies, Indoor and outdoor patients of medicine department, Rational drug use, WHO drug use indicators.

I. Introduction

Drug therapy plays a crucial role in improving human health by enhancing the quality of life and extending the life expectancy. A method to evaluate and improve drug use is by conducting Drug Utilization Studies (DUS). Drug Utilization is defined by the WHO (world health organization) as the marketing, distribution, prescription, and use of drugs in society with special emphasis on the resulting medical, social and economic consequences [1]. Antimicrobial agents (AMA) have changed the attitude of physicians about the influence of drugs on the diseases. Antimicrobials are the most common drugs, used for several life threatening as well as trivial infections. Their importance is exaggerated in the developing countries, where infective diseases are predominant [2]. But inappropriate and haphazard use of antimicrobials has led to the development of antimicrobial resistance, treatment failure and an increase in mortality and morbidity [3, 4]. The worldwide increase in antimicrobial resistant bacteria is of great concern, but is not defined satisfactorily in the developing countries. Hence, it is the responsibility of the doctors to develop good prescribing practices.

Some of the common causes that contribute to the spread of antimicrobial resistance are unnecessary use, inappropriate dose, inadequate duration of therapy of antimicrobials and use of irrational antimicrobial fixed dose combinations (FDCs). Because of the high level of community antimicrobial resistance, use of expensive alternative antimicrobials becomes mandatory which may not be affordable to majority of patients in developing countries like India. Another problem is that many of the second and third line antimicrobials are becoming ineffective in clinical practice. And as it is reported earlier, "the slow pace with which new molecules of antimicrobials are introduced into the market is inadequate to meet the needs of this global threat" [3].

To tackle with this problem, global initiatives are trying to promote rational use of antimicrobials [3, 5] but, it requires continuous education of prescribers and patients, which ought to be supported by high quality evidence linking antimicrobial use to the emergence of resistance [6, 7]. Therefore, the present study was conducted to generate a baseline data on antimicrobial drug prescribing pattern in indoor patients admitted in medicine wards and outdoor patients visiting medicine outpatient department (OPD) and to suggest necessary modifications in antimicrobial drugs prescribing practices in order to achieve the rational and evidence based therapeutic practices so as to prevent the problem of antimicrobial resistance in the region.
II. Materials And Methods

2.1 Study design: This was a prospective cross sectional observational study conducted at the tertiary care hospital of B. J. Government Medical College and Sassoon General Hospitals, Pune. Total 1000 prescriptions from indoor and outdoor patients of medicine department were collected for a period of 3 months, i.e. March 2017 to May 2017. The data was collected after getting permission from the respective head of the departments for analysing the prescriptions and after getting approval from the Institutional Ethics Committee. Strict confidentiality of the prescriber and patient was maintained during the study period. The number of antimicrobials prescribed in each prescription was taken into account to calculate the incidence of polypharmacy.

2.2 Data collection: The data of first consecutive 1000 eligible indoor and outdoor patients of medicine department was obtained from case records. The inclusion and exclusion criteria were as follows-

Inclusion criteria
1) Patients admitted in medicine IPD from March 2017 to May 2017
2) Patients visited in medicine OPD from March 2017 to May 2017
3) Patients of age more than 12 years of either sex
4) Patients on antimicrobial therapy

Exclusion criteria
1) Pregnant patients
2) Patients of age less than 12 years

The data from the records were entered into a specially designed proforma. The following parameters were recorded for each prescription: patient’s demographic profile, diagnosis, drug’s name, dose, route, frequency and duration of prescription. The patients were categorized by sex and then divided into four age groups. The frequency of prescription was calculated for each age group and for males and females separately. Prescribing frequency was expressed as a percentage of the prescription of the individual drug/drug class in a particular age/sex category to the total number of patients in the particular age/sex category.

2.3 Prescription pattern: WHO guidelines were taken into consideration in evaluating the rationality of prescriptions [1]. Drug utilization parameters were compared between prescriptions of indoor and outdoor patients. Evaluation of prescription was done with help of hospital antibiotic polymer to measure their rationality [8]. Data and results were represented in suitable graphical and tabular forms.

III. Results

Total first 1000 consecutive prescriptions of indoor and outdoor patients of medicine department were assessed. It consisted of 240 (24%) indoor patients and 760 (76%) outdoor patients (Fig.1).

Figure 1: Distribution of indoor and outdoor patients in medicine department.
Prescriptions of 240 indoor patients were further categorized on the basis of predominant systems involved because of which patients got admitted in medicine ward. Cardiovascular system was commonly affected (36.25%) system amongst indoor patients (Fig. 2).

**Figure 2:** Distribution of system wise diagnosis of indoor patients in medicine department for which antimicrobials were prescribed.

A total of 760 patients of medicine OPD were categorised according to diseases like respiratory tract infections which consisted of 287 (37.76%) patients followed by 196 (25.79%) gastrointestinal infections, 106 (13.95%) genitourinary infections, 104 (13.68%) pyrexia of unknown origin (PUO), 32 (4.21%) surgical infections and 35 (4.61%) patients in miscellaneous category were included (Fig. 3). The most common diagnosis which warranted antimicrobial prescription in the medicine OPD was respiratory tract infection followed by gastrointestinal infection and urinary tract infection.

**Figure 3:** Disease pattern of outdoor patients in medicine department for which antimicrobials were prescribed.

Out of 240 indoor patients, 153 (63.75%) were male while 87 (36.25%) were female. Out of 760 outdoor patients, 403 (53.03%) were males and 357 (46.97%) were females. Majority of indoor patients were from age group of 46 – 60 years while majority of outdoor patients were from age group of 31 –45 years (Table 1).

CVS – Cardiovascular system, RS - Respiratory system, CNS - Central nervous system, GIT - Gastrointestinal system

**RTI:** Respiratory tract infection; GITU: Gastro-intestinal tract infection; GUI: Genito-urinary infection; PUO: Pyrexia of unknown origin; SI: Surgical infection
Table 1: Age and sex distribution of indoor and outdoor patients in medicine department

<table>
<thead>
<tr>
<th>Age group</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 – 30 years</td>
<td>7 (4.57%)</td>
<td>4 (4.6%)</td>
<td>11 (4.58%)</td>
<td>37 (9.18%)</td>
<td>32 (8.96%)</td>
<td>69 (9.08%)</td>
</tr>
<tr>
<td>31 – 45 years</td>
<td>47 (30.72%)</td>
<td>34 (39.08%)</td>
<td>81 (33.75%)</td>
<td>167 (41.44%)</td>
<td>136 (38.1%)</td>
<td>303 (39.87%)</td>
</tr>
<tr>
<td>46 - 60 years</td>
<td>68 (44.44%)</td>
<td>37 (42.53%)</td>
<td>105 (43.75%)</td>
<td>156 (38.71%)</td>
<td>128 (35.85%)</td>
<td>284 (37.37%)</td>
</tr>
<tr>
<td>&gt;60 years</td>
<td>31 (20.26%)</td>
<td>12 (13.79%)</td>
<td>43 (17.92%)</td>
<td>43 (10.67%)</td>
<td>61 (17.09%)</td>
<td>104 (13.68%)</td>
</tr>
<tr>
<td>Total</td>
<td>153 (63.75%)</td>
<td>87 (36.25%)</td>
<td>240</td>
<td>403 (53.03%)</td>
<td>357 (46.97%)</td>
<td>760</td>
</tr>
</tbody>
</table>

During the study period, 1649 drugs were prescribed for 240 indoor patients (6.87 drugs per prescription), out of which 878 (53.24%) were antimicrobials. Hence, 3.66 antimicrobials were prescribed per prescription in indoor patients. 4420 drugs were prescribed for 760 patients in outdoor patients (5.82 drugs per prescription), out of which, 1395 (31.56%) were antimicrobials. Hence, 1.84 antimicrobials were prescribed per prescription in outdoor patients. When assessed about the number of antimicrobials per prescription, it was found that most commonly three antimicrobials per prescription were prescribed in 44.58% of prescriptions and two antimicrobials per prescription were prescribed in 33.33% of prescriptions in indoor patients. It was found that most of the outdoor prescriptions were consisted of two antimicrobials per prescription (64.08%) followed by single antimicrobial per prescription (34.21%) (Table 2).

Table 2: Number of antimicrobials prescribed per prescription in medicine department

<table>
<thead>
<tr>
<th>No of antimicrobials per prescription</th>
<th>Number of indoor patients (%)</th>
<th>Number of outdoor patients (%)</th>
<th>Total = Indoor + outdoor patients (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>13 (5.42%)</td>
<td>260 (34.21%)</td>
<td>226 (22.6%)</td>
</tr>
<tr>
<td>2</td>
<td>80 (33.33%)</td>
<td>487 (64.08%)</td>
<td>547 (54.7%)</td>
</tr>
<tr>
<td>3</td>
<td>107 (44.58%)</td>
<td>13 (1.71%)</td>
<td>179 (17.9%)</td>
</tr>
<tr>
<td>4</td>
<td>36 (15%)</td>
<td>0 (0.0%)</td>
<td>44 (4.4%)</td>
</tr>
<tr>
<td>5-8</td>
<td>4 (1.67%)</td>
<td>0 (0.0%)</td>
<td>4 (0.4%)</td>
</tr>
<tr>
<td>Total</td>
<td>240</td>
<td>760</td>
<td>1000</td>
</tr>
</tbody>
</table>

Antimicrobial drugs utilization pattern was studied separately. Antimicrobial drugs prescribed and frequency of their use in outdoor and indoor patients was given in Fig 4 and Fig 5.

Figure 4: Antimicrobial drugs prescribed in outdoor patients in medicine department
It was observed that, parenteral dosage form of antimicrobials was commonly utilized in indoor patients (87.93%) followed by oral dosage form of antimicrobials (11.62%) while oral route was obviously preferred for antimicrobials administration in outdoor patients (96.06%) of medicine department. Injectable dosage form was not at all used in outdoor patients (Table 3).

Table 3: Dosage forms of antimicrobials utilized in indoor and outdoor patients in medicine department

<table>
<thead>
<tr>
<th>Dosage Forms</th>
<th>Indoor patients</th>
<th>Outdoor patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oral</td>
<td>102 (11.62%)</td>
<td>1340 (96.06%)</td>
</tr>
<tr>
<td>Parenteral</td>
<td>772 (87.93%)</td>
<td>0</td>
</tr>
<tr>
<td>Topical</td>
<td>4 (0.46%)</td>
<td>55 (3.94%)</td>
</tr>
<tr>
<td>Total</td>
<td>878</td>
<td>1395</td>
</tr>
</tbody>
</table>

It was observed that most of the antimicrobials were prescribed by brand names in indoor and outdoor patients. Statistically, higher percentages of prescriptions were found to contain brand names in indoor (84.88%) than outdoor (69.89%) patients of medicine department. Prescriptions were further assessed for their consistency with national list of essential medicines 2015 (NLEM 2015). It was also observed that all the antimicrobials prescribed in outdoor patients were found to be from NLEM 2015 while 99.66% antimicrobials prescribed in indoor patients were found in NLEM 2015. Among the different classes of antimicrobial combinations, amoxicillin + clavulanic acid injection 1.2gm remained the most frequently prescribed combinations in indoor patients followed by amoxicillin+ clavulanic acid tablet 625mg and piperacillin + tazobactam tablet. In outdoor patients, only prescribed was amoxicillin+clavulanic acid tablet 625mg. Total of 138(15.72%) and 455(32.62%) fixed dose combinations of antimicrobials were prescribed in indoor and outdoor patients of medicine departments respectively. Only 27.92% indoor patients had undergone microbial culture and sensitivity test, whereas this test was not at all used in outdoor patients to guide the treatment (Figure 6).

Figure 6: Percentage distribution of patients on antimicrobial drugs undergone microbial culture and sensitivity test
Evaluation of antimicrobial prescriptions was done on the basis of hospital antibiotic policy [8] to measure rationality of prescribing practices. The sample of only 27.92% of indoor patients was tested for microbiology culture and sensitivity (fig 6). This may have contributed to higher number of irrational prescriptions in indoor patients (43.75%). Even in outdoor patients, 26.84% prescriptions were found to be irrational (Table 4). Overall, rational versus irrational ratio was 7:3 in study population (Table 4).

Table 4: Evaluation of antimicrobial prescriptions

<table>
<thead>
<tr>
<th>Evaluation on the basis of hospital antibiotic policy</th>
<th>Number of indoor patient's prescriptions (%)</th>
<th>Number of outdoor patient's prescriptions (%)</th>
<th>Total (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rational</td>
<td>135 (56.25%)</td>
<td>556 (73.16%)</td>
<td>691 (69.10%)</td>
</tr>
<tr>
<td>Irrational</td>
<td>105 (43.75%)</td>
<td>204 (26.84%)</td>
<td>309 (30.90%)</td>
</tr>
<tr>
<td></td>
<td>240</td>
<td>760</td>
<td>1000</td>
</tr>
</tbody>
</table>

IV. Discussion

Prescription monitoring studies are important for obtaining data about the patterns and rationality of use, the determinants of drug use, and the outcomes of use. The WHO drug utilization indicators [1] are highly standardized and are recommended for inclusion in drug utilization studies. Antimicrobial resistance is one of the major global preventable problems. The causes of antimicrobial resistance are unnecessary use, inappropriate doses, inadequate duration of therapy and irrational fixed dose drug combinations [3]. Average number of drugs per person is an important index of prescription audit. Mean number of drugs per prescription should be kept as low as possible. Polypharmacy always lead to increased risk of drug interactions, adverse effects, development of bacterial resistance and increased hospital cost [9, 10, 11].

This study was undertaken to evaluate the rational use of antimicrobials in the indoor and outdoor patients of medicine department of a tertiary level teaching hospital. The study population included indoor and outdoor patients on antimicrobials from medicine department. Majority of patient’s case records belong to outdoor patients. The principle reason could be due to number of outdoor patients per day is far greater than indoor patients per day in medicine department in this hospital.

Cardiovascular system was commonly involved system in indoor patients. This could be because of higher prevalence of ischaemic heart diseases in critical care units. Pandianumian J et al [12] also found in their study that ischemic heart disease was most frequent cause of admissions to indoor medicine department. Nibrad VV et al [13] also in their study found that most of cases admitted in intensive care unit were related to cardiovascular system and myocardial infarction and angina pectoris were top clinical diagnoses. In this study, it was also found that there was a trend towards prescribing antimicrobials for common ailments like infections of upper and lower respiratory tract, gastrointestinal tract and genitourinary tract in outdoor patients in medicine department. The prescribing frequency of antimicrobials is similar to the results of previous studies from India and other developing countries [3, 14].

The demographic results of patients revealed that number of male patients outnumbered female patients in medicine IPD. Same outcome was obtained in outdoor patients of medicine department. This was comparable with Beg MA et al study [9]. Badar VA et al [15] in a study found similar results about gender distribution as 57.29% males and 42.7% females. The reason for more male admissions in this study may be that female patients are reluctant to utilize health care facilities unless they are critically ill. The another reason for more male admissions in this study may be attributed to more male to female ratio in Maharashtra and in the Indian scenario. In indoor patients, comparatively more patients were admitted in the age group of 46-60 years while majority of outdoor patients were from age group of 31-45 years. The age distribution for indoor and outdoor patients was different. Beg MA et al [9] in a study obtained different results about age distribution in indoor patients of medicine department where majority of the patients were in 16-30 years age group, followed by in 31-45 years age group. In this study, age group of 46-60 years patients were frequently admitted in medicine wards as risk factors such as hypertension, diabetes mellitus and cerebrovascular events are more common after age of 45 years [12].

In this study, the average number of drugs per prescription was 6.87 in indoor patients while 5.82 in outdoor patients, indicating polypharmacy. This result was comparable with study by Beg MA et al [9]. On an average 3.66 antimicrobial drugs were prescribed per prescription in indoor patients and 1.84 antimicrobials were prescribed per prescription in outdoor patients. Usually more than one antimicrobial drug was prescribed to indoor and outdoor patients of medicine department. This finding in the study is comparable with Najmi MH et al study [16]. Comparatively more number of antimicrobials was used per prescription in medicine wards. This reflects patients admitted in wards were suffered from multiple infections that required multiple antimicrobials to treat. Polypharmacy with regard to antimicrobials was observed in indoor patients than outdoor patients in medicine department. That could be because of higher incidence of serious infections or nosocomial

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infections in indoor patients than outdoor patients. Yet number of antimicrobials per prescription should be kept low to prevent antimicrobial resistance as well as to reduce hospital cost [9].

Ceftriaxone was the most frequently prescribed antimicrobials in indoor patients while amoxicillin + clavulanic acid was largely used in outdoor patients. This pattern has been seen in previous studies too [9, 12, 17]. This may be because cephalosporins are effective against vast majority of organisms, have convenient dosing schedules and have fewer adverse effects; hence they are being prescribed more frequently both in wards and out-patient clinics. This may be one of the reasons for emergence of cephalosporin resistance in developing countries like India [18]. Amoxicillin + clavulanic acid was the most commonly prescribed drug in outdoor patients in this study. This outcome was similar with the previous study in which more use of extended spectrum penicillins was observed [19].

Most of the antimicrobials prescribed in indoor patients were given in injectable form (87.93%) indicating the seriousness of the infections. Beg MA et al [9] and Najmi MH et al [16] also got similar results in their study where 68.48% prescriptions found to include injectable forms. But obvious, oral dosage form of antimicrobials was usually preferred in outdoor patients. In this study, it was observed that, most of the antimicrobials were prescribed by brand names in indoor patients. However, percentage of prescribing by brand name was higher in indoor (84.88%) than outdoor (69.89%) patients. Some other studies done in South India also confirmed that the tendency of physicians to prescribe drugs by generic names was less at tertiary care centres and out-patient clinics [13, 20]. Prescribing drugs by brand names increase economic burden of the patients as they are costlier than the generic versions available in the market.

About 99.66% and 100% of the prescribed antimicrobial drugs were from the NLEM 2015 [21] in indoor patients and outdoor patients respectively. Adhikari et al [22] and Sreesha et al [23] have shown that 45.1% and 56% of prescribed antimicrobials were consistent with NLEM 2011 which was lower as compared to this study reflecting a better level of adherence to prescribing from NLEM 2015. About 15.72% and 32.62% fixed dose combinations (FDCs) of antimicrobials were prescribed in indoor and outdoor patients respectively. Injectable form of Amoxicillin+clavulanic acid was commonly used fixed dose combination in indoor patients while oral dosage form of Amoxicillin+clavulanic acid was frequently prescribed in outdoor patients. Similarly, in Khan et al study [19], Amoxicillin+clavulanic acid was commonly prescribed fixed dose combination.

About 27.92% of indoor patients were prescribed one or more antimicrobials underwent microbiological culture and sensitivity test. It is recommended to have microbiological culture and sensitivity tests to know whether organism is sensitive to a particular antimicrobial or not to have proper treatment. It was observed that many antimicrobials were prescribed without any culture evidence in indoor patients. In Saache et al study [24], only 26% of patients underwent microbiological culture and sensitivity test investigations in medicine intensive care units of same institute. So there is a need to have awareness about prescribing antimicrobials on the basis of culture and sensitivity report not only in patients of general wards but also in intensive care units to guide the therapy.

The present study had certain limitations. The study was carried out over a three month period only. Only first consecutive 1000 prescriptions were considered for analysis, out of them 240 were indoor patients and 760 were outdoor patients and these may not have been representative of the patient population. Moreover, the depth and quality of data available at health facilities influenced the variables that could be studied. Variables such as diagnostic tests performed and their outcomes, signs of infection, prescriber type and characteristics, patient load, previous treatment, concurrent medications etc. may influence antimicrobial prescribing behaviour. However, these variables were not considered in this study. The patient’s knowledge of the duration of treatment, proper time to take the medication was not assessed too. Further studies over longer period of time with a large sample size in various prescribing setup will give us better insight regarding prescription writing practices. Such type of studies provides necessary feedback to prescribers and may prove useful to formulate antibiotic policy to policy makers. However, this study has dealt basic concept and identified key areas which require modifications for rational drug use.

V. Conclusion

Based on the results, it was concluded that third generation cephalosporins and extended spectrum penicillins were the most frequently prescribed AMAs in indoor and outdoor patients respectively. The number of drugs prescribed by generic names was low in the indoor patients and effort must be made to encourage prescribing by generic names. The proportion of antimicrobials use for bacteriologically proven infection was low in indoor patients and efforts to prescribe antimicrobials on a sound bacteriological basis should be encouraged.

Antimicrobial prescriptions were rational regarding their duration of administration, route, and the indication but not supported by culture and sensitivity reports. The prescription based on culture and sensitivity reports leads to decrease in haphazard use of antimicrobials but patient’s load is very high at government
hospitals. Hence, it may not be feasible to do culture and sensitivity test for each and every patient. For proper antimicrobial prescribing, the clinician should try to define the type of infection and the presumable causative organisms. There is an antibiotic policy in tertiary care hospital regarding the use of antimicrobials. So proper implementation of antibiotic policy will result in improved clinical outcomes. Proper antibiotic stewardship guidelines should be followed to tackle the problem of antimicrobial resistance which is growing very fast due to excessive and inappropriate use of these drugs.

The worldwide increase in antimicrobial resistant bacteria is of great concern and it is the responsibility of the doctors to develop good prescribing habits which will help in reducing the intensity of the problem. Since resident doctors are future prescribers, there is need to sensitize an issue of prescribing skills in them to promote judicious use of antimicrobials. And comparative drug utilization studies of AMA can be planned in different set ups to assess rational prescribing of antimicrobials.

References


