

Original Article

**A STUDY ON PRESCRIBING PATTERN OF ANTI MICROBIAL AGENTS IN THE MEDICAL INTENSIVE CARE UNIT OF A TERTIARY CARE TEACHING HOSPITAL IN PUDUCHERRY UNION TERRITORY, SOUTH INDIA**

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**ABSTRACT**

**Objective:** This prospective observational study was conducted to assess the prescribing pattern of antimicrobial agents in the MICU of a tertiary care teaching hospital in Puducherry Union Territory and to suggest necessary modifications in prescribing drugs to achieve rational therapeutic practices.

**Methods:** 100 consecutive inpatient records of patients admitted to the MICU during September to December, 2013 were studied.

**Results:** Average number of AMAs per patient was found to be 1.13. Cephalosporins and Ceftriaxone were the most frequently prescribed Anti microbial group and agent respectively in the MICU. Organisms isolated in the culture and sensitivity tests were sensitive to Imipenem and Piperacillin + Tazobactam in common. No adverse drug reaction was observed for any AMA. Brand name of the drugs and parenteral route of administration were preferred by the physicians for prescribing the AMAs. Most AMA prescriptions were made without bacteriological culture and sensitivity testing evidences.

**Conclusion:** There is a need for motivating the physicians to prescribe antimicrobial agents by generic names with supportive bacteriological evidences. Antibigram need to be framed and followed.

**Keywords:** Antimicrobial Agents, MICU, Prescribing pattern, Cephalosporins.

**INTRODUCTION**

Antimicrobial agents are prescribed very often inappropriately and also inadequately and thus in medical practice, they have become one of the highly abused drugs [1]. This widespread and indiscriminate use of antimicrobial agents inevitably has resulted in the emergence of antibiotic resistant pathogens. This practice of indiscriminate prescribing of AMAs also leads to ineffective and unsafe treatment, prolongation of illness, disease exacerbation, distress and harm to the patients. All these issues produced a great concern over the inappropriate and injudicious use of antimicrobial agents all over the world [2].

Patients admitted to the Medical Intensive Care Unit (MICU) are seriously ill and are often suffering from chronic critical illnesses. These patients receive multiple medications from a variety of pharmacological classes due to various life threatening illnesses [3]. Such patients in the MICU are at a higher risk of developing hospital acquired infections and antimicrobial agents are the most powerful and useful tools to manage these infections. The widespread use of broad spectrum antibiotics in the ICUs has lead to the emergence of several resistant strains of microbes. This contributes significantly to raise the health care costs and also patient morbidity and mortality [4 - 6].

It is extremely imperative to evaluate and monitor the prescribing pattern of antimicrobials from time to time for enabling suitable modifications in prescribing patterns; to increase the therapeutic benefits and also to decrease the adverse effects for optimizing the health care services [7]. Little is known about the prescribing pattern of antimicrobial agents in the Medical Intensive care Units in South India. Such knowledge is important for health policy-makers to identify targets for improving antimicrobial utilization and thus optimizing costs, therapy and disease management. Hence we planned our study with the following objectives.

1. To evaluate the prescribing pattern of antimicrobial agents in the Medical Intensive Care Unit of Mahatma Gandhi Medical College and Research Institute (MGMC & RI), Pondicherry.

2. To analyse the sensitivity pattern of culture isolates to antimicrobial agents and
3. To assess the incidence of adverse drug reactions to AMAs in the MICU.

**MATERIALS AND METHODS**

It was a prospective observational study done with case records of patients admitted in the MICU of Mahatma Gandhi Medical College & Research Institute, Puducherry, from September to December 2013. Approval for the study was obtained from the Institutional Human Ethics Committee (IHEC) and waiver for informed consent also was obtained.

Case records of patients who got transferred to other speciality Intensive Care Units or another ward or discharged within 24 hours of admission were excluded from the study. To evaluate the drug prescribing pattern a data collection proforma sheet was prepared. The proforma contained details such as demographics (age, sex, occupation), diagnosis, duration of stay in the hospital, outcome of the treatment, number and types of antimicrobial agents prescribed, generic or brand name of drugs, their routes of administration, frequency and adverse effects of drug (if any as mentioned in the case record) and relevant investigation results.

Data of the first 100 eligible consecutive case records of patients admitted to the MICU during the study period were taken for the study. The data were then recorded in the proforma. Descriptive statistics was applied to the data using SPSS version 17 and the results were analysed.

**RESULTS**

Out of the hundred patients, 63 (63%) were male patients and 37 (37%) were females. Age of the patients was ranging between 14 years and hundred years and the mean age was found to be 53.02 ( $\pm$  SD 16.01) years. Among the 100 patients, 14 were from Puducherry and 86 were from Tamilnadu state. The most frequent diagnoses which warranted admissions were Ischemic Heart disease (44%),

Fever for evaluation (25%), cerebro-vascular accident (8%), Hypertensive and Diabetic emergencies (5%) and COPD (5%). Minimum duration of stay of a patient in the MICU in the study sample was one day and the maximum duration was 68 days and mean duration of stay was found to be 9.46 ( $\pm$  SD 7.99) days. Maximum number of drugs prescribed for a patient was 19. The mean number of drugs received by patients in the present study was 10.4 $\pm$ 2 drugs. Patients admitted with cardiovascular events like IHD

and cerebrovascular accidents were exposed to more number of drugs during hospital stay.

Polypharmacy was noticed in all the case records. Anti peptic ulcer drugs were the most commonly administered drug which had been prescribed to 93% of the patients. Out of the hundred records studied, 43(43%) were not been prescribed any antibiotics during the course of their treatment.

**Table 1: Age group of patients admitted in the MICU**

S. No.	Age in years	Number of patients(n=100)	Percentage of patients
1	14-30	10	10%
2	31-40	12	12%
3	41-50	20	20%
4	51-60	23	23%
5	61-70	22	22%
6	71-80	09	9%
7	81-100	04	4%

**Table 2: Utilization of various groups of AMAs in the MICU**

S. No.	Group of AMAs	No. of prescriptions	% of prescriptions
1	Cephalosporins	40	35.6
2	Penicillins	24	21.3
3	Fluoroquinolones	10	8.8
4	Metronidazole	9	8
5	Aminoglycosides	8	7.1
6	Macrolides	8	7.1
7	Others	14	12.1
	<b>Total</b>	<b>113</b>	<b>100</b>

**Table 3: Prescribing frequency of systemic antimicrobial agents in the MICU**

S. No.	Drug	No. of prescriptions	% of prescription
1	Cefazolin	2	1.8
2	Ceftriaxone	26	23
3	Cefotaxime	7	6.2
4	Cefixime	1	.9
5	Cefoperazone + Sulbactam	2	1.8
6	Ceftazidime	2	1.8
7	Ampicillin + Cloxacillin	2	1.8
8	Cloxacillin	2	1.8
9	Phenoxymethylpenicillin(Kaypen)	5	4.4
10	Ampicillin	9	8.0
11	Amoxicillin + clavulanic acid	2	1.8
12	Piperacillin + Tazobactam	7	6.2
13	Amikacin	4	3.5
14	Gentamicin	4	3.5
15	Azithromycin	7	6.2
17	Ciprofloxacin	5	4.4
16	Clarithromycin	1	.9
18	Levofloxacin	4	3.5
19	Norfloxacin	1	.9
20	Metronidazole	9	8.0
21	Fluconazole	3	2.7
22	Vancomycin	3	2.7
23	Antitubercular drugs	1	.9
24	Doxycycline	1	.9
25	Nitrofurantoin	1	.9
26	Meropenem	1	.9
27	Artesunate	1	.9
	<b>Total</b>	<b>113</b>	<b>100.0</b>

**Table 3** shows the prescribing frequency of different AMAs in the MICU during the study period. Ceftriaxone, Ampicillin, Metronidazole, Cefotaxime, Piperacillin + Tazobactam, and Azithromycin were found to be prescribed more frequently. Ceftriaxone was prescribed as initial therapy empirically in cases of pyrexia of unknown origin until the investigation reports were received. For suspected respiratory tract infections Azithromycin, Ampicillin and Amoxicillin + Clavulanic acid were preferred by the Physicians. For suspected Urinary tract infections Fluoroquinolones were prescribed.

**Table 4: Distribution of patients according to the number of AMAs Prescribed to them.**

S. No	Number of AMAs	Number of Patients	% of Patients receiving AMAs
1	0	43	43%
2	1	26	26%
3	2	14	14%
4	3	9	9%
5	4	8	8%
	Total	57	100%

**Table 4** shows the distribution of patients depending upon the number of AMAs they received during their total duration of stay in the MICU. 8% of the patients received 4 AMAs during their stay. Ampicillin was co-prescribed along with Gentamicin and Cefotaxime was co-prescribed with Amikacin in many case records.

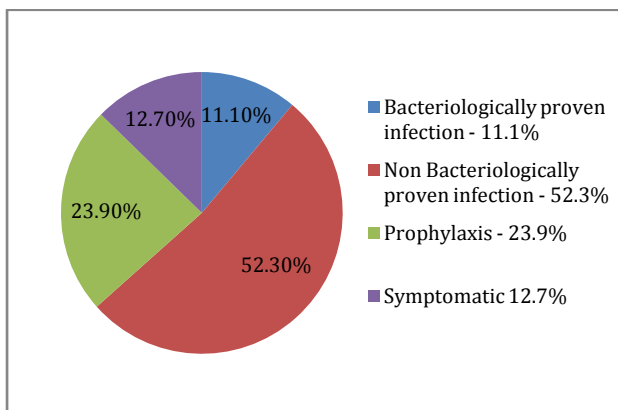
Remaining 57(57%) were prescribed one or more AMAs. 113 antibiotic prescriptions were made for the 57 patients who received AMAs. Totally 27 types of AMAs were prescribed. Fixed drug combinations such as *Cefoperazone + Sulbactam*, *Ampicillin + Cloxacillin*, *Piperacillin + Tazobactam*, *Amoxicillin + clavulanic acid* and the Antitubercular drugs prescriptions were considered as a single type of AMAs prescribed. AMAs belonging to the Cephalosporins, Penicillins and Fluoroquinolones were the frequently utilized group of AMAs in the MICU as shown in the table 2.

#### Route of administration of the AMAs

Among the 113 AMA prescriptions in MICU 82(72.56%) were administered in injection form parenterally (intravenously) and remaining 31(27.43%) prescriptions were given orally in either tablet or capsule form.

#### Indications for AMA usage

113 prescriptions made for the 57 patients were categorised into four categories based upon the reason for utilization of AMAs and the percentage of each category for prescribing AMAs was found as shown in **Figure 1**.

**Fig. 1: Indications for AMA usage**

#### Culture and sensitivity testing results

From eleven patients various specimens were sent for culture and sensitivity. In that three reports shown positive culture. *E.coli* was detected twice and *Acinetobacter* grown in the culture once. They were found to be resistant to Amoxicillin, Amoxicillin + Clavulanic acid and ceftazidime while sensitive to Piperacillin + Tazobactam and Imipenem in common. In all other instances AMAs were prescribed based on the clinical features and with the evidence of other relative indicators of infection like Total and differential WBC counts, urine microscopy, X ray chest, Platelet count and ESR.

#### Percentage of AMAs prescribed in generic names

Among the 113 AMAs prescribed, 33 (29.20%) were prescribed in generic names and the remaining 80 (70.79%) were prescribed in brand names.

#### Adverse reaction to AMAs

No adverse drug reaction to any AMA prescribed was recorded in the case records studied. One patient had history of allergic reaction to a drug (unknown), but that patient didn't develop hypersensitivity reaction to any drug prescribed during his duration of stay in the MICU.

#### DISCUSSION

The demographic results of patients admitted to the medical ICU over a period of 4 months revealed male preponderance (63:37) with a mean age of around 53 years, similar to a study done in Bangalore by Lisha et al [8]. Smythe et al [3] study done outside India did show that equal numbers of male and female patients were admitted to the medical ICU with a mean age of 65 years. The reason for more male admissions in our study may be attributed to more male to female ratio in Tamilnadu and puducherry and in the Indian scenario it is noticed that female populations are reluctant to utilize health care facilities even if they are critically ill. Most of the admissions were from Cuddalore district of Tamilnadu state, as no tertiary care centre is present in the district and MGMC&RI is at Pillaiyarkuppam which is just around six kilometres from the border of the district of cuddalore.

The mean number of drugs received by patients in the present study (10.4±2 drugs) was comparable to Smythe et al study [3] (12±7.6 drugs) and Lisha et al [8] (11.6±2) study but higher compared to report from Western Nepal [9] which recorded a mean of 5.1±2.7 drugs. Patients with cardiovascular diseases and more comorbid conditions were given more number of drugs during the stay. Maximum number of drugs administered to a patient in our study was lesser than the findings of similar other studies done in India but polypharmacy was observed in majority of case records in this study.

In contradiction to previous reports by Smythe et al [3] and Biswal et al [10] who documented cardiovascular drugs and antimicrobials as the commonest therapeutic class, anti peptic ulcer drugs (92% patients) especially the proton pump inhibitors were the most frequently prescribed drug class in our study which is in accordance with the report of Lisha et al [8]. In an ICU setup aggressive prophylactic and therapeutic utilization of anti-peptic ulcer agents can be explained by the higher occurrence rate of stress induced and drug induced ulcers among the critically ill patients.

Cephalosporins (35.6%) and Penicillins (21.3%) were the most commonly prescribed groups of AMAs in this study. The commonest AMA prescribed was Ceftriaxone, this is in accordance with similar study [11] done in Saudi where Ceftriaxone was prescribed most in patients (57%) as initial therapy. Vandana AB et al [12] observed that Cefotaxime was the most prescribed AMA, where as ampicillin, amoxicillin, metronidazole, ciprofloxacin and crystalline penicillin were the 5 most commonly prescribed antibiotics in the study done in 2003 conducted by Shankar et al [9]. Older studies on AMA prescription pattern found that penicillins and aminoglycosides were the most utilized AMAs. But similar recent studies done in this decade in our country documented that third generation cephalosporins are the most prescribed AMAs in the ICUs as well as in the out-patient clinics in India [12-14]. This may be due to cephalosporins being safer with a fewer adverse effects and as they

are effective against most common pathogens, they are being prescribed more in this decade for empirical therapy in the Intensive Care Units and also in out-patient clinics. But this also may result in selection of cephalosporin resistant bacteria in this part of the earth [15].

The common indication for use of antibiotics in our study was infection (63.4%) followed by prophylactic (23.9%) and symptomatic (12.7%). This is comparable to the result given by Vandana AB et al [12] wherein the indications were infection - 64.9%, prophylaxis - 11% and symptomatic - 24%. In our study, patients with heart diseases who needed surgical intervention were admitted in a good number preoperatively and patients who were intubated and catheterised were given prophylactic AMA therapy. This may be the possible reason for more prescription of AMA therapy prophylactically compared to other studies. The culture and sensitivity reports did show that *E.coli* and *Acinetobacter* which were isolated found to be resistant to Aminopenicillins and were sensitive only to higher AMAs like Imipenem and Pipracillin + Tazobactam. Thus, care should be taken to avoid development of further resistance to AMAs. As intravenous access was there, the in-patients are sick and as most of the available effective AMAs are available in injection form, most of the AMAs (72.56%) were administered intravenously in this study. One remarkable finding noticed in the study was most (70.79%) of the AMAs were prescribed in their brand names. Some other studies done in this part of South India also confirmed that the tendency of clinicians to prescribe drugs by generic names is less in tertiary care centres and out-patient clinics [13,16]. This needs great caution and necessary modification as prescription guidelines always advice for prescribing drugs in generic names. Prescribing drugs in brand names increase economic burden of the patients as they are costlier than the generics available in the market.

#### CONCLUSION

Based on the results, we conclude that in the MICU, third generation Cephalosporins are the most frequently prescribed AMAs. The number of drugs prescribed by generic names was low in the MICU and effort must be made to encourage prescribing by generic names. The proportion of antibiotic use for bacteriologically proven infection (directed) was low and efforts to prescribe antibiotics on a sound bacteriological basis should be encouraged.

AMA prescriptions were rational regarding their duration of administration, route, and the indication but not supported by culture and sensitivity reports. Because in this study, culture and sensitivity testing was not done in many patients of MICU who received AMAs and mostly the results of the performed tests found that no organisms were grown in culture. For proper antimicrobial prescribing, the clinician should try to define the type of infection and the presumable causative organisms. Antibigram specific to the institute and the ward needs to be framed and followed in all the wards of the institute. Initial antibiotic therapy can be started based on the antibiogram. Adjustment of the initial therapy based on the results of further culture and sensitivity reports and the clinical course of the illness are the relevant steps in antimicrobial prescribing. A committee should be involved in the ICU to monitor the prescription pattern of AMAs regularly.

No adverse drug reaction to any AMA has been recorded in any of the patient records in the study.

As there are no study reports from this part of South India depicting the prescribing pattern of AMAs in the MICU in Tamilnadu and Puducherry, this study will serve to provide a data regarding the current prescribing pattern of AMAs in this part of India.

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