

## Research Article



## Study of Prescribing Pattern of Antimicrobial Agents in Medicine Intensive Care Unit of a Tertiary Care Hospital in Bihar

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### ABSTRACT

**Introduction:** Medical Intensive Care Unit (MICU) is a setup where very serious patients are admitted and large numbers of drugs are administered to these patients. Usually, cost of these prescribed drugs is very high. The aim of the current study was to assess the pattern of prescriptions being made for antimicrobial agents in MICU of a tertiary care hospital of Bihar.

**Methods:** This prospective study was undertaken in MICU of Indira Gandhi Institute of Medical Sciences, Patna, Bihar over a period of six months from January 2018 to June 2018. Patients' records, prescription and treatment charts were reviewed. Rationality of different drugs used in MICU patients were also evaluated.

**Results:** In MICU, meropenem was most commonly prescribed antimicrobial agent. It was seen among 24% patients, closely followed by clindamycin (22%), ceftriaxone (20%), piperacillin + tazobactam (18%) and metronidazole (12%). Majority (92%) of the patients admitted in MICU were given 2-3 antimicrobial agents and rest were given 4-7 such drugs. Most common indication for prescription was infection with septicemia.

**Conclusion:** Management of critically ill patients in MICU should be focused not only on control of infection but also on proper use of antibiotic. This will help to minimize emergence of drug resistance, unnecessary cost burden to the patients and adverse drug reactions.

**Keywords:** Antimicrobials, Medicine intensive care unit, Prescription.

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### INTRODUCTION

**A**ntimicrobial resistance is a global public health challenge which has been accelerated over the past decade by overuse of antibiotics worldwide. Increase in antimicrobial resistance is the cause of severe infections, complication; longer hospital stays and increase morbidity and mortality. Over prescription of antibiotics is associated with an increased risk of adverse effects. Antibiotics are most commonly used drugs especially among the inpatients of medicine department and that too among the critically ill patients in MICU of any hospital. A variety of modalities and developments have been achieved by the medical science to control infections and hence reduce related morbidity and mortality, but still such infection poses a significant core of patient care till today. This huge burden of infections among hospitalized

patients in any health care facility led to increased number of prescriptions of antimicrobial agents being made. The rate of such prescriptions is 10 times higher among patients in MICU than in other general medical wards.<sup>1</sup> This scenario makes it inevitable to rationalize the use of such antimicrobial agents. This would in turn help to enhance treatment success rate and reduce emergence of resistant micro-organisms. Hence, the clinical lifespan of these drugs would be prolonged.<sup>2</sup>

However, management of critically ill patients in MICU is a massive challenge to the medical fraternity as extreme pharmacokinetics (PK) variability has been encountered among these patients.<sup>3</sup> The conventional dosing of antimicrobial agents often is seen to result in clinical failure among patients in MICU, the prominent reason being that most of the clinical studies to calibrate the dosing of such drugs include patients from general wards as their study population. This discrepancy in the literature indeed is the most prominent cause of low drug dosing leading to therapeutic failure along with emergence of antimicrobial resistance<sup>4</sup>, or excess drug dosing exposing these patients to more risk of toxicity. With this background, the current study was designed to encourage appropriate and proper use of antibiotics prescriptions in MICU of a tertiary care hospital as this is an important element in patient



treatment, infection control and cost containment.<sup>5,6</sup> Many of the previous authors in this field<sup>7,8</sup> have already expressed their concern on this invariable, indiscriminate and unjustified use of antimicrobial agents that in turn lead to emergence of resistant organisms in the ecosystem. To combat this emerging problem, it is inevitable to procure correct knowledge of using antimicrobial agents along a healthy prescription practice.

Increase antimicrobial resistance is the cause of severe infection, complication, longer hospital stays, health care cost and increased patients' morbidity and mortality. The ICARE study provided evidence that the huge burden of antibiotic resistance is noted among critically ill patient as compared to their control population.<sup>9</sup> This study showed that treatment given by any specialist of the field rather than a comparatively less competent medical practitioner help to bring down the expenses on the antibiotics by at least 45%.<sup>9</sup> Available literatures on antimicrobial use abroad and in India bears testimony to the widespread concern about appropriate use of these agents.<sup>10</sup> Hence, in this prospect, proper skill and competence in prescribing drugs should be reinforced time and again with continuous assessment and required corrections. The area of concern should not be limited to knowledge of drug pharmacology and pathophysiology of the disease but must also envisages diagnostic acumen and judicial prescription attitude, keeping patients' well-being and expenses in mind.<sup>11</sup>

The study to assess the prescribing patterns of antimicrobial agents are aimed to evaluate and make necessary corrections if any discrepancy in practice is noted. The ultimate goal is to rationalize the treatment at all levels to benefit the patients for their own wellbeing and to minimize the cost of treatment. Correct skill and practice of prescription is inevitable to combat the global problem of emerging antibiotic resistance.<sup>6</sup> Multiple studies from Indian authors have been documented on antibiotic utilization pattern at an institutional level. The current study was planned to evaluate the prescription practice of various antimicrobial agents among patients admitted in medical ICU of Indira Gandhi Institute of Medical Sciences, Patna which is a tertiary health care center of the state.

## MATERIALS AND METHODS

An observational study was conducted by the Department of General Medicine of Indira Gandhi Institute of Medical Sciences, Patna. The study included randomly selected prescriptions of patients from Medical ICU of the hospital over a period of six months from January 2018 to June 2018. The study was approved by the Institutional Ethics Committee. Inclusion criteria considered for the study were: 1) Adult patients of both genders, 2) Prescriptions with at least one antibiotic. While prescription of pregnant and lactating women was excluded. The demographic and clinical treatment data were collected that included age and gender of the patient, diagnosis, number of AMA

prescribed, dose and route of administration of these AMA and rationality of use of prescribed AMA.

## Indication of use

Drug therapies were categorized according to indication for prescribing AMA. Broadly, three groups were defined to categorize the patients for treatment:

1. Group A included patients for whom the indication for use of AMA was underlying infections that was confirmed clinically or by laboratory data.
2. Group B included patients for whom AMA were prescribed as prophylaxis to prevent emergence of any super-added infections.
3. Group C included cases where no symptomatic indication or no evidence of prophylaxis could be established, but patients were being treated with AMA for the treatment of the same symptoms e.g., prescribing drugs for fever without evidence of any infection.

## Rationality of use

1. The therapy was considered rational if the prescription of AMA was appropriate according to the type of infection identified. This included the type of AMA prescribed, route of administration, dose, frequency and duration
2. Therapy was considered irrational if the AMA was used without any without indication of either infection or prophylaxis or was administered through inappropriate route, dose or preparation.
3. Therapy was considered questionable if insufficient clinical or laboratory data were found to classify the treatment as rational or to start the particular therapy like a patient of congestive heart failure was prescribed AMA for cough in lack of evidence that cough was due to CHF or infection.

## Data analysis

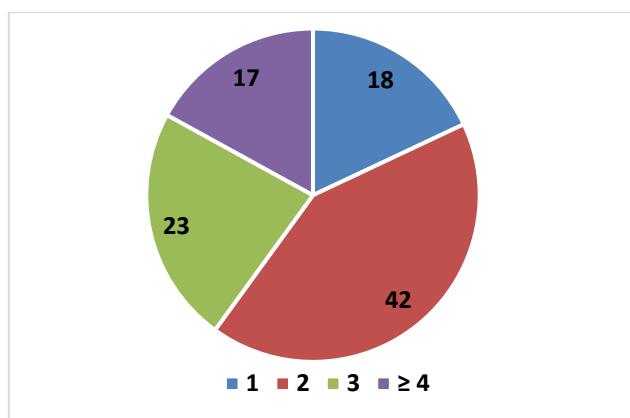
Relevant information from the collected data was entered and analyzed using Statistical Package for Social Sciences ver 21.0 (IBM, Chicago). Descriptive statistics was performed. Proportion of patients in various categories has been expressed as absolute number and percentage. Result has been expressed as test, tables or figures, as appropriate.

## RESULTS

In this study, a total of prescription of 100 patients admitted in MICU were collected to obtain required information for the study. The male to female ratio was almost 1 (1.04). The mean age of patients was 51.6 years with a SD of 12.8 years. Patient characteristics has been given in details in table 1. The most common cause of admission in MICU was septicemia, acute kidney injury, multi-organ dysfunction, followed by COPD with acute exacerbation and LRTI, CKD, type 2 diabetic mellitus. [Table



2]. It was found that meropenam was most common prescribed AMA among these patients followed by clindamycin, ceftriaxone, piperacillin + tazobactum. [Table 3] Others antibiotics used were injection of cefoperazone, linezolid, moxifloxacin, amoxicillin + clavulanic acid, amikacin, levofloxacin, tigecycline, colistin, streptomycin and tablets of rifaximin, doxycycline and Anti-tubercular drugs. As for the number of AMA prescribed, 18% of MICU patients received 1 AMA, 42% patients were given 2AMAs, 23% received 3 AMAS, and 17% received 4 and more than 4 AMAs. [Figure 1] Indication and rationality of use of AMA has been distributed as discussed in the methodology section. Septicemic infections were the most common indication (58%) for AMAs followed by prophylactic use (23%). As for rationality, 46% prescription for AMAs were considered rational, 51% were irrational and 13% use were questionable. [Table 4]



**Figure 1:** Pie chart showing distribution of prescriptions based on number of AMA prescribed

**Table 1:** Table showing distribution of patient based on their baseline characteristics

Patient characteristics	Number
<b>Gender</b>	
Male	56
Female	54
<b>Age distribution</b>	
18-30 years	8
31-40 years	13
41-50 years	31
51-60 years	28
> 60 years	20
<b>Length of ICU stay</b>	
1-5 days	49
6-10 days	35
11-15 days	7
> 15 days	9
<b>Outcome of patient</b>	
Shifted to wards	63
Discharged	2
Death	28
Left Against Medical Advice (LAMA)	7

**Table 2:** Distribution of prescriptions based on the primary diagnosis

Primary diagnosis	Number
Septicemia	62
Acute Kidney Injury	13
COPD with acute exacerbation and LRTI	11
Multi-organ dysfunction	7
Chronic Kidney Disease	3
Others	4

**Table 3:** Commonly prescribed Anti-microbial Agent

S. no	Drug	Number	Serial no	Drug	Number
1	Meropenam	24	13	Amikacin	6
2	Clindamycin	22	14	ATT	5
3	Ceftriaxone	20	15	Tigecycline	5
4	Piperacillin+ tazobactam	18	16	Amoxy+clavulanic acid	4
5	Metronidazole	12	17	Cefepime	4
6	Cefoperazone	9	18	Teicoplanin	4
7	Moxifloxacin	8	19	Azithromycin	2
8	Linezolid	7	20	Gentamycin	2
9	Vancomycin	6	21	Streptomycin	2
10	Levofloxacin	6	22	Colistin	2
11	Rifaximin	6	23	Doxycycline	2
12	Meropenam	24			



**Table 4:** Evaluation of patients based on indication and rationality of use of AMA

Evaluation criteria	Number
<u>Indication of use</u>	
Infection/Septicemia	48
Prophylactic	32
Symptomatic	20
<u>Rationality of use</u>	
Rational	46
Irrational	51
Questionable	13

## DISCUSSION

An observational study was conducted among patients admitted in Medical Intensive Care Unit of a literary care hospital of Bihar. The study tried to highlight the prescription practice regarding Anti-microbial Agents in this hospital. The purpose of the study was to evaluate this practice and find any prevailing problem in the prescription practice.

The most common indication of admission was infections/septicemia with multi organ dysfunction. Patients had been administered variety of drugs and AMAs. In our study the commonest AMA prescribed was meropenem (24%), followed by clindamycin (22%), ceftriaxone (20%), piperacillin +tazobactam (18%) and metronidazole (18%). Similar study done by Vandana A Badar et al showed that in ICU, cefotaxime was most commonly used AMA (32%).<sup>9</sup> Similarly, Hanssens et al<sup>10</sup> concluded in their study that in MICU, almost three-fourth of the patients were started on AMAs. A survey to analyze the utilization of AMA was performed at two different health care facility and revealed that 35.3% and 39% of the patients who were admitted at these centers were given single AMA or in various combination.<sup>11</sup> Ceftriaxone was most commonly prescribed for patients (57%) as initial therapy,<sup>10</sup> whereas another study by Shankar et al found that ampicillin, amoxicillin, metronidazole, ciprofloxacin and crystalline penicillin were among the most common prescriptions.<sup>12</sup>

Patients admitted in intensive care units are almost always in critical condition, so they receive parenteral route for treatment and prevention of any life-threatening situation. In our study infection/septicemia were the common indication for antimicrobial therapy; this supported by similar study where 76% patients were treated for presumed or proven infections and received antibiotics.<sup>10</sup> Majority of the patients (83%) were given at least one antibiotic; this is similar to findings of Hanssens Yet al (76%)<sup>10</sup> and Shankar et al (92%)<sup>13</sup> in teaching hospital of western Nepal but contrary to van der Meer JW et al<sup>14</sup> shows 30% were prescribed antibiotics during the study period. Similarly, study done by Bosu et al<sup>15</sup> again had found different pattern of prescriptions at different health

facilities, that varies from 41% to 98%. It is not possible to draw any firm conclusion since the patients are not matched socio- economically.

In our center, majority of the patients suffered from mixed infections, hence, they were given AMA in various combinations as per their bacteriological profile. So many times, antibiotics are kept on changing from one class to another class of drugs when the first one is not effective or patients not responding till culture reports were available.

In this study, 46% of AMAs were rational, 51% irrational and 13% questionable. Using a different set-up, it has been demonstrated that the intervention of a physician specialist in Clinical Pharmacology was effective in reducing antibiotic costs by 51% when a prescription-point prevalence analysis was performed for comparison between two internal medical departments.<sup>11</sup> The common indication for use of antibiotic was infection (48%) followed by symptomatic 32%, prophylactic 20%. The percent of patients treated for infections was 48% which less than reported by other studies.<sup>16</sup> The percent of prophylactic treatment prescribed is 32% which is in accordance with 13% and 10.3% reported in previous studies.<sup>14, 15</sup>

We found that the average number of drugs prescribed in the MICU was 8-10. In another study the number was 12.1 ± 7.6.<sup>17</sup> The average number of drugs in our study was less than or comparable to that reported in other studies. This is an important surrogate marker for ethical and rational drug use in any prescription audit. It is advised to retain the average number of drugs per prescription to the lowest possible number, as more the drugs mean more drug interaction. Also, this may predispose emergence of bacterial resistance and hence, increased hospital cost.<sup>18</sup>

So, measures should be taken care to avoid the inappropriate use of antibiotics. Physicians must have a good knowledge and clear understanding of therapeutic use of antibiotics and their cost burden to the patients. They must be aware about the prevalence of various pathogens and resistance patterns in their hospital and exercise good judgment in selection empirical antimicrobial agents.<sup>1</sup>

## CONCLUSION

Antibiotics are the widely used drugs in MICU patients. Many innovations have been achieved in the field of medicine, but still, antibiotics resistance is at alarming rate leading to increase morbidity, mortality and cost burden to the patients. All clinician must follow standard antimicrobials prescription protocol in clinical practice to minimize the antimicrobial resistance and cost burden to the patients. Rampant use of newer AMAs such as meropenem, clindamycin, ceftriaxone and piperacillin +tazobactam have been noticed, which creates a huge out of pocket expenditure for the patients which is comparable to other published data.



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