

Research Article**Prescribing Pattern of Antibiotics in Intensive Care Unit of a Tertiary Care Teaching Hospital**Roshan Adhikari^{1*}, Farnoosh Nemati¹, Ms. AhamadaSafna Mariyam², Dr. Uday G.³¹Pharm.D, Department of Pharmacy Practice, Acharya & BM Reddy College of Pharmacy, Bangalore-560107²M.Pharm, Department of Pharmacy Practice, Acharya & BM Reddy College of Pharmacy, Bangalore-560107³Assistant Professor, Department of Medicine, Dr. B.R. Ambedkar Medical College, Bangalore-560045

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ABSTRACT

Antibiotics are the most commonly administered drugs in ICU. By optimizing the use of antibiotics within ICU, patient outcomes are improved, better initial antibiotics administration is provided, and the chance of further antibiotic resistance are minimized. **Objective:** To analyze the prescribing pattern of antibiotics prescribed in the Intensive Care Unit in Dr. B. R. Ambedkar Medical College and Hospital. **Methodology:** A prospective and observational study was carried out for six months (August 2015 – January 2016) in Dr. B. R. Ambedkar Medical College and Hospital. A total of 63 prescriptions were analyzed from the ICU for evaluating prescription pattern of antibiotics. **Result:** Total 63 patients were enrolled, out of which 63.49% were males and 36.51% were females. A total of 129 antibiotics were prescribed and Nitroimidazoles (23.26%) were the most commonly prescribed antibiotics in the ICU and lincosamide was the least commonly prescribed antibiotics. **Conclusion:** In medical practice, antibiotics have become one of the highly abused drugs so it is essential to evaluate the prescribing pattern of antibiotics in order to optimize the health care services.

Keywords: antibiotics, prescribing pattern, ICU.**Introduction**

Antibiotic is a chemical that is produced by a microorganism and has the ability to harm other microbes by suppressing the growth or kill them at very low concentration^[1]. Some of the antibiotics may inhibit bacterial wall synthesis, or may increase cell membrane permeability and some antibiotics may cause lethal inhibition of bacterial protein synthesis or nonlethal inhibition of protein synthesis etc. But they exert no action for the infection caused by viruses such as cold, flu, sore throats, bronchitis etc.^[2]. Antibiotics are obtained from fungi, bacteria, actinomycetes etc.

The objective of our study is:

- To evaluate prescribing pattern of antibiotic in the ICU patients.
- To list out the drug interactions and Adverse Drug Reactions encountered.

Antibiotics can be classified based on their mechanism of action, chemical structures, type of organisms against which primarily active, spectrum of activity, type of action etc.^[1]. Antibiotics have three general uses: empirical therapy, definitive therapy and prophylactic therapy^[3]. Empirical therapy includes the use of broad-spectrum antibiotics which treat both the gram-positive and gram-negative bacteria. In many situation it is not possible to do the specific bacteriological diagnosis and the selection of single narrow-spectrum antibiotic may be inappropriate so empirical therapy is given to the patient. But once the infecting microorganism is identified, the course is completed with more specific and narrow-spectrum low-toxicity antibiotics called as definitive therapy^[4]. According to the study done in antibiotic use in US hospital the most commonly prescribed antibiotics were vancomycins, ceftriaxone, piperacillin-tazobactam, levofloxacin etc.^[5]. Patient who are seriously ill and often suffering from chronic critical illness are admitted

to the ICU. These patients are commonly prescribed with antibiotics at the time of admission. Antibiotics are commonly prescribed to hospitalized patients in the departments like surgery department and ICUs^[6]. Antibiotic resistance is the major worldwide problem. Improper use of antibiotics is the primary cause of antibiotic resistance. However the other cause of antibiotic resistance includes the frequent use of broad spectrum antibiotics, the crowding of patients with complex medical problems into small areas of the hospital, and the presence of more chronically and actually ill patients who require prolonged hospitalization. Antibiotic resistance may lead to increased morbidity, mortality, increased healthcare expenditure and increased length of hospital stay^[7]. Antibiotic resistance is occurring more rapidly and more frequently in gram-positive bacteria and gram-negative bacteria all over the world^[8,9]. Due to increasing antibiotic resistance in the Intensive Care Units and with limited availability of antibiotics to treat new forms of organisms, there is an urgent need for immediate surveillance to study the trends of antibiotic use in the Intensive Care Units and to investigate the factors that may influence the pattern of antibiotic prescriptions by healthcare professionals in ICUs^[10]. The last decade has witnessed the increasing problem of antibiotic resistance as a consequence of excessive or inappropriate antibiotic use. Critically ill patients treated in ICUs frequently have an infection or are prone to develop new infections^[11]. Patients admitted to intensive care units are more prone to develop Healthcare-associated infections than patients admitted to other wards. The risk of infection and the frequency of infection at different anatomic sites vary by the type of ICU. Similarly the frequency of specific pathogens varies by infection site. ICU nosocomial infections are primarily related to the patients' health status, invasive device utilization such as venous central line, mechanical ventilation and long term urinary catheterization, use of immunosuppressors, prolonged hospitalization, colonization by resistant microorganisms and antibiotic prescriptions^[12]. The international study of infections in ICU, which was conducted in 2007, demonstrated that the patients who had longer ICU stays had higher rates of infection. Up to 70% of nosocomial infections

are now caused by organisms resistant to one or more drugs^[13].

Antibiotics use in ICU for Prescribing Practices: Patients in ICU are mostly prescribed with antibiotics. The ICARE study established the high incidence of antibiotic resistance in an intensive care unit in comparison to the community. It was demonstrated in the ICARE study that an infectious disease specialist intervention brought about a 45% decrease in antibiotic expenses^[14]. According to the drug use pattern study from an ICU in northern India, the average age of patient studied was 49 years and had a average LOS of 5.75 days. The total number of patient discharged was 60.50% and expired was 39.50%. 95% of ICU admitted patient were prescribed with antibiotics. In the study 2000 patients were received 1246 drugs and 418 antibiotics during their stay in the hospital, the average number of drugs and antibiotics prescribed per patient were 6.23 and 2.09, antibiotics constituted 33.54% of the total drug prescribed^[15]. Similarly, study was done in drug use patterns from an ICU in Iran, so according to the study the average age if patients studied were 50 years with an average LOS of 6 days and the other data reported that the average duration of patient stay in the ICU was 7 days^[16,17]. A total of 656 antibiotics were empirically prescribed during 4-month study period which was studied in the survey on antibiotic prescribing patterns in ICUs of Australia and New Zealand^[18]. A study in a Danish University hospital ICU reported that the majority of their patients were on one antibiotic,^[19] whereas 36.7% of cases were treated with single antibiotic agents, 14.1% were given a combination of 2 antibiotics and 7.2% were given a combination of ≥ 3 antibiotics agents in a German surgical ICU^[20].

METHODOLOGY:

Study Design and Human Ethical Clearance:

This study was carried out for a period of 6 months from August 2015 to January 2016 in the Intensive Care units of Dr. B.R Ambedkar Medical College and Hospital which is a 760 bedded multispecialty tertiary care teaching hospital in Bengaluru. The study protocol was approved by the Institutional Ethical Committee (IEC) with ethical clearance number: EC-384.

Inclusion Criteria:

- Patients of either sex, aged above 18 years.
- Patients admitted and prescribed with antibiotics in Medical Intensive Care Unit and Surgical Intensive Care Unit.

Exclusion Criteria:

- Patients admitted in departments other than Intensive Care Unit.
- Any case of road traffic accident, medico legal case.

Method:

• All the patients admitted in the Medical Intensive care unit and Surgical Intensive Care Unit who met the inclusion criteria were recruited for the study. The patients or the care givers were informed about the details of the study and their oral consent has been obtained. The data has been collected from the patient case sheets, treatment chart, by communicating with the physicians and nurses. The patients demographics like age, gender, body weight was collected by direct interview from patient/patient care givers. The medication profile of the patient was obtained from the medication chart which includes the data

like time and dosing of antibiotics administered, past medical history, reason for admission, co morbidities, clinical data such as various laboratory reports and therapeutic data including dose, duration, frequency, route, time of administration and concomitant medication. The collected data was then entered in Microsoft Excel® and the prescribing pattern of antibiotics. The collected data was analyzed for mean, standard deviation and percentage calculation wherever applicable.

RESULT**Demographic data:**

Among 63 patients the ratio to male: female was found to be almost 2:1. In our prospective study conducted to analyze the prescription pattern of antibiotics in Intensive Care Units, 63 patients were enrolled from Medical Intensive Care Unit and surgical Intensive Care units out of which 63.49% were males and 36.51% were females out of total study population 69.84% were admitted to Medical Intensive Care Unit (MICU) and 30.16% were admitted to Surgical Intensive Care Unit (SICU). The detailed demographic data is illustrated in Table 1

Table 1:

Gender	Patient	Percentage
Male	40	63.49%
Female	23	36.51%

Age distribution of the study:

Age of the patients was ranging between 18 and 85 years and the mean age of our study subjects was found to be 53.93 ± 16.47 years. The detailed is illustrated in table no .2

Table 2:

Age	Patient	percent
Less than 30 years	7	11.11%
30-40 years	4	6.35%
40-50 years	13	20.63%
50-60 years	13	20.63%
60-70 years	17	26.98%
70-80 years	9	14.29%

The average length of ICU stay was 5.46 ± 3.24 days ranging from a minimum of 2 days to a maximum of 14 days.

Prescription pattern of antibiotic class and antibiotics in the ICU:

A total of 129 antibiotics were prescribed for these 63 patients. Nitroimidazoles were the most commonly prescribed antibiotics in the ICU. It was prescribed to 23.26% of the patients followed by 3rd generation cephalosporins with β -lactamase inhibitors (17.05%), 3rd generation cephalosporins (15.50%), extended spectrum penicillin with β -lactamase inhibitors (14.73%), carbapenams (6.98%), and aminoglycosides (5.43%). The detailed data is illustrated in table no. 3 and table no. 4.

Table 3:

Antibiotic Groups	Percent
Nitroimidazole	23.26%
3 rd generation cephalosporin with β -lactamase inhibitor	17.05%
3 rd generation cephalosporin	15.50%
Extended spectrum Penicillin with β -lactamase inhibitor	14.73%
Carbapenam	6.98%
Aminoglycosides	5.43%

Table 4:

Antibiotics	Percent
Metronidazole	21.71%
Piperacillin with Tazobactam	14.73%
Ceftriaxone	11.63%
Ceftriaxone with Tazobactam	10.85%
Meropenam	6.98%
Ceftriaxone with Sulbactam	6.20%

Distribution of patients according to the number of antibiotics prescribed to them:

The number of antibiotics prescribed to the patients admitted in the ICU varied as per the diagnosis. Out of 63 patients, 28.57% of the patients were receiving only 1 antibiotic whereas 41.27% of patients were receiving 2 antibiotics and 25.40% of the patients were receiving 3 antibiotics and 4.76% of patients were receiving 4 antibiotics as illustrated in table no. 5

Table 5:

Number of Antibiotics	percent
1	28.57%
2	41.27%
3	25.04%
4	4.76%

Route of administration of antibiotics:

Intravenous administration of antibiotics was found to be most common (90.77%) route in our study. Oral administration of antibiotics was found in 9.23% of our study population. The detailed is illustrated in table no.6

Table 6:

Route of Administration	Percent
IV	90.07%
PO	9.92%

Categorization of Drug Interactions in our study population:

The prescription of our study population was analyzed for drug interactions, and found 5.80% major drug interactions, 18.84% were moderate drug interactions and 75.36% minor drug interactions. No adverse drug reactions were identified in our study population. The detail is illustrated in table no. 7

Table 7:

Type of Drug Interaction	percent
Major	5.80%
Moderate	18.84%
Minor	75.36%

Discussion:

Antibiotics prescription is inevitable in Intensive Care Units (ICU). Our study which aims to evaluate the prescription pattern of antibiotics, recorded a total of 63 patients according to the inclusion and the exclusion criteria. The study was conducted in the Medical Intensive Care unit and Surgical Intensive Care Unit of Dr. B. R. Ambedkar Medical College and Hospital, Bengaluru.

In our study, out of 63 patients' 63.49% were males and 36.51% were females. The mean age of our study cohorts was found to be 53.93±16.47 years which is similar to the prospective observational study conducted at ICU of a tertiary care teaching hospital in Puducherry Union Territory, South India by Pandiamunian J et al., in his study 63% were males and 37% females, the mean age of his study population was found to be 53.02±16.01 years^[29].

Another prospective study conducted by Badar VA et al., in Central India shows that 57.29% were male patients and 42.7% were female patients, the mean age of her study subjects was found to be 50 years^[14]. From this analysis it was found that male patients' were more in ICU than female patients'. The age of the patients' commonly admitted in ICU was around 50 – 60 years.

The average length of stay in hospital for our study population was found to be 5.46±3.24 days, and 53.96% of our study patient were hospitalized for a time period of less than and equal to 4 days. This

data of our study deviates from an observational prospective study conducted in Bahrain to analyze the antibiotics prescription pattern in the ICU by Ansari AA et al., in their study the mean LOS of the patient was 7.5 days^[26]. Another study conducted by Smythe MA et al., to analyze the medication utilization review in ICU found that the mean LOS of 5.2±9.8 days^[30]. This shows wide variation in the Length of Stay in hospital, which might be due to variations in the severity of illness and health care practices of the individual patients' as well as in the country.

In our study, nitroimidazole was the most common antibiotics used in the ICU. It was prescribed to 23.26% of the patients followed by 3rd generation cephalosporins with β -lactamase inhibitors (17.05%), 3rd generation cephalosporins (15.50%), extended spectrum penicillin with β -lactamase inhibitors (14.73%), carbapenams (6.98%), and aminoglycosides (5.43%). This data of our study deviates from an observational prospective study conducted in Bahrain to analyze the antibiotics prescription pattern in the ICU by Ansari AA et al., in their study Meropenem was the most common antibiotics used in the ICU which was prescribed to 39 patients. The other five most frequently used antibiotics in the ICU in their study were Flagyl, erythromycin, Rocephin, Tazocin and Ciprofloxacin^[26].

Whereas in the prospective observational study conducted at ICU of a tertiary care teaching hospital in Puducherry Union Territory, South India

by Pandiamunian J et al., the most commonly prescribed antibiotic was Cephalosporins. It was prescribed to 35.6% of the patients. The other five most frequently used antibiotics in their study were Penicillins (21.3%), Fluoroquinolones (8.8%), Metronidazole (8%), Aminoglycosides (7.1%) and Macrolides (7.1%)^[29].

In another prospective study conducted at Medicine Intensive Care Unit of a Teaching Hospital in Central India by Badar VA et al., the most common antibiotics used in ICU were Cefotaxime. It was prescribed to 32% of the patients. The other five most frequently used antibiotics in the ICU in their study were Metronidazole (24.2%), Ampicillin (17.3%), Meropenem (9.5%), Amoxicillin + clavulanic acid (8.1%) and levofloxacin (7.5%)^[14]. In another prospective and observational study conducted at Intensive Care Unit in Northern India to analyze antibiotic prescription patterns at admission into a tertiary level intensive care unit by Williams A et al., the most commonly prescribed antibiotics at ICU admission was cefoperazone (26% of all prescriptions) followed by Metronidazole, Levofloxacin, Meropenem, Ceftriaxone and Imipenem^[15]. In another one – day point prevalence study to investigate the patterns of antibiotic in 72 Latin American (LA) ICUs conducted by Curcio D et al., carbapenems (imipenem or meropenem) were the antibiotics most frequently prescribed (35%), followed by vancomycin (25%), broad – spectrum Cephalosporins (mainly Cefepime, Ceftazidime and Ceftriaxone) (22.5%), Piperacillin – Tazobactam (18%) and fluoroquinolones (12%). In 38% of the cases, carbapenems were prescribed in combination with Vancomycin. Carbapenems were most frequently used in culture- directed prescriptions^[31].

In another prospective observational study conducted at Intensive Care Unit by Mangrulkar S et al., Piperacillin/Tazobactam and 3rd Generation Cephalosporin are used frequently as Empiric antibiotic. Fluoroquinolones were also found to be used frequently^[32].

In our study out of 63 patients, 28.57% of the patients were receiving only 1 antibiotic whereas 41.27% of patients were receiving 2 antibiotics and 25.40% of the patients were receiving 3 antibiotics and 4.76% of patients were receiving 4 antibiotics.

In an observational prospective study conducted in Bahrain to analyze the antibiotics prescription pattern in the ICU by Ansari AA et al., in their study out of 75 patients, 26 were on one antibiotic only, but the majority (36) patients were on two antibiotics, five patients required 3 antibiotics and only 2 required 4 antibiotics^[26]. In another prospective and observational study conducted at Intensive Care Unit in Northern India to analyze antibiotic prescription patterns at admission into a tertiary level intensive care unit by Williams A et al., out of 200 patients, 54 patients were on one antibiotics, 86 patients were on two antibiotics, 36 patients were on 3 antibiotics, 7 of them were on 4 antibiotics, 8 of them were on >5 antibiotics and 9 of them were not receiving antibiotics^[15].

In our study, the prescriptions were analyzed for drug interactions and 5.80% major drug interactions, 18.84% moderate drug interactions and 75.36% minor drug interactions were found. Where as in a prospective observational study conducted by Ray S et al., at Medical/Surgical ICU of a tertiary-care hospital the major drug interactions were 21.63% and moderate drug interactions were 23.08% and minor drug interactions were 55.29% according to the severity of and requirement for drug modification^[33]. In another prospective observational study that was conducted in the Medical ICU of an academic medical center by Smithburgur PL et al., from 240 patients medication profile 457 drug-drug interactions were identified among which 25% were considered major drug-drug interactions^[34]. In another prospective study conducted by Nazariab M et al., in Shaheed Beheshti Medical University, Tehran, Iran, they found 413 drug interactions from 567 prescriptions among which 17.43% were major drug interactions, 73.61% were moderate and 8.96% were unknown^[35].

On analyzing the route of administration of antibiotics in our study, intravenous administration of antibiotics was found to be most common (90.77%) route whereas oral administration of antibiotics was found in 9.23% of the total study population which is slightly lesser than a prospective and observational study conducted at pediatric ward and ICU of a tertiary care hospital in Northern India by Kanish R et al. In their study on analyzing the route of administration of antibiotics 92.21% of antibiotics

were given parenterally, 6.70% were given through oral route, 0.55% were given intramuscularly and 0.27% were given intraocularly and topically^[36].

Conclusion:

The aim of the study was to study the prescribing pattern of antibiotics prescribed in the Intensive Care Unit. The most commonly prescribed antibiotics in ICU were nitroimidazole, nitroimidazole, 3rd generation cephalosporin with β -lactamase inhibitors, 3rd generation cephalosporins, extended spectrum penicillin with β -lactamase inhibitors, carbapenams and aminoglycosides.

In medical practice antibiotics have become one of the highly abused drugs as they are prescribed very often inappropriately and also inadequately. It is extremely essential to evaluate and monitor the prescribing pattern of antibiotic 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.

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