RESEARCH PAPER

Antimicrobial Prescribing Patterns in Critical Care Units of a Tertiary Care Hospital in Western India: A Cross-Sectional Study

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Abstract
Background: Inappropriate antimicrobial use in intensive care units (ICUs) significantly contributes to antimicrobial resistance, prolonged hospital stay, and increased healthcare costs. Evaluation of prescribing patterns is essential to promote rational drug use and strengthen antimicrobial stewardship programs in tertiary care settings.
Objectives: To assess antimicrobial prescribing patterns in critical care units of a tertiary care hospital in Western India and evaluate their rationality using standard treatment guidelines and WHO prescribing indicators.
Methods: A cross-sectional observational study was conducted over a period of 6 months in the medical and surgical ICUs of a tertiary care teaching hospital in Western India. A total of 220 patients receiving antimicrobial therapy were included. Data regarding demographic characteristics, diagnosis, indication, antimicrobial agents, route, duration, and combination therapy were collected from patient records. Prescriptions were analyzed using WHO core drug use indicators and evaluated for appropriateness as per standard guidelines.
Results: Among 220 patients, 62.3% were male, with a mean age of 54.6 ± 16.2 years. Empirical antimicrobial therapy was initiated in 78.6% of cases, while definitive therapy based on culture reports was observed in 21.4%. The most commonly prescribed classes were beta-lactams (68.2%), carbapenems (34.5%), and glycopeptides (18.6%). Combination therapy was noted in 64.1% of patients, with an average of 2.3 antimicrobials per prescription. Intravenous administration accounted for 92.7% of prescriptions. Microbiological culture testing was performed in 56.8% of cases. Approximately 38.2% of prescriptions were found to be non-compliant with standard treatment guidelines, indicating irrational use.
Conclusion: The study demonstrates a high prevalence of empirical and broad-spectrum antimicrobial use in ICU settings, with significant reliance on combination therapy and deviations from standard guidelines. Strengthening antimicrobial stewardship interventions, promoting culture-guided therapy, and periodic prescription audits are essential to optimize antimicrobial use and combat resistance.

Keywords: Antimicrobial prescribing, Critical Care Unit, drug utilization, antimicrobial stewardship, tertiary care hospital
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Introduction

Antimicrobial agents are among the most commonly prescribed drugs in intensive care units (ICUs), where critically ill patients are at high risk of severe infections and sepsis. However, inappropriate and excessive use of antimicrobials has emerged as a major global concern due to its direct contribution to antimicrobial resistance (AMR), increased morbidity and mortality, prolonged hospital stay, and rising healthcare costs[1]. The burden of AMR is particularly high in developing countries like India, where factors such as over-the-counter availability of antibiotics, lack of stringent prescription policies, and inadequate antimicrobial stewardship programs contribute to irrational drug use[2].

ICUs represent a unique clinical setting characterized by the frequent use of broad-spectrum antibiotics, empirical therapy, and combination regimens due to the severity of illness and urgency of treatment[3]. Although early initiation of antimicrobial therapy is critical in life-threatening infections, inappropriate selection, dosing, and duration of therapy can lead to adverse outcomes, including emergence of multidrug-resistant organisms (MDROs)[4]. Studies have reported that nearly 30–50% of antimicrobial prescriptions in hospital settings may be inappropriate or unnecessary, highlighting the need for regular evaluation of prescribing practices[5].

Drug utilization studies play a crucial role in assessing prescribing patterns, identifying irrational practices, and providing baseline data for improving the quality of healthcare delivery[6]. The World Health Organization (WHO) has developed standardized prescribing indicators to evaluate rational drug use, including the

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average number of drugs per encounter, percentage of drugs prescribed by generic name, and proportion of encounters with antibiotics[7]. Such evaluations are particularly important in ICUs, where polypharmacy and high antibiotic usage are common.

In recent years, antimicrobial stewardship programs (ASPs) have been emphasized as an effective strategy to optimize antimicrobial use, reduce resistance, and improve patient outcomes[8]. These programs promote evidence-based prescribing, encourage culture-guided therapy, and advocate periodic audit and feedback mechanisms. Despite these recommendations, implementation of stewardship practices remains inconsistent in many tertiary care hospitals, especially in resource-limited settings[9].

Understanding the local antimicrobial prescribing patterns is essential for developing targeted interventions and hospital-specific antibiotic policies. However, there is limited data from Western India regarding antimicrobial utilization in critical care settings. Therefore, the present study was undertaken to evaluate antimicrobial prescribing patterns in ICUs of a tertiary care hospital and to assess their rationality using WHO prescribing indicators and standard treatment guidelines.

Materials and Methods

This cross-sectional observational study was conducted over a period of six months in the medical and surgical intensive care units (ICUs) of a tertiary care teaching hospital in Western India. The study aimed to evaluate antimicrobial prescribing patterns and assess their rationality using World Health Organization (WHO) prescribing indicators and standard treatment guidelines[7]. A total of 220 patients admitted to the ICUs and receiving at least one antimicrobial agent during their hospital stay were included in the study. Patients of all age groups and both genders were considered, while those with incomplete medical records or who were discharged within 24 hours of admission were excluded. The study was approved by the Institutional Ethics Committee, and patient confidentiality was strictly maintained.

Data were collected prospectively from patient case records and ICU drug charts using a structured data collection form. Information regarding demographic characteristics (age, gender), clinical diagnosis, indication for antimicrobial therapy, type and class of antimicrobial agents prescribed, route of administration, duration of therapy, and use of single or combination therapy was recorded. Details regarding microbiological investigations, including culture and sensitivity testing, were also noted to assess the extent of culture-guided therapy. Antimicrobial agents were classified according to standard pharmacological classes, and their utilization patterns were analyzed.

Prescribing practices were evaluated using WHO core drug use indicators, including the average number of antimicrobials per prescription, percentage of encounters with injectable antimicrobials, and use of broad-spectrum antibiotics[7]. The rationality of antimicrobial prescriptions was assessed by comparing them with standard treatment guidelines, taking into account appropriate drug selection, dose, route, and duration of therapy[8]. Prescriptions not adhering to recommended guidelines were considered irrational.

Data were entered and analyzed using Statistical Package for the Social Sciences (SPSS) version 20. Descriptive statistics were used to summarize the data, and results were expressed as mean ± standard deviation for continuous variables and percentages for categorical variables. Associations between variables were analyzed using the Chi-square test, and a p-value of <0.05 was considered statistically significant.

Results

A total of 220 patients admitted to the intensive care units (ICUs) and receiving antimicrobial therapy were included in the study. Among them, 62.3% were males and 37.7% were females, with a mean age of 54.6 ± 16.2 years (Table 1).

Empirical antimicrobial therapy was initiated in 78.6% of cases, while definitive (culture-guided) therapy based on microbiological reports was observed in 21.4% of patients (Table 2). The most commonly prescribed antimicrobial classes were beta-lactams (68.2%), followed by carbapenems (34.5%) and glycopeptides (18.6%) (Table 3).

Combination antimicrobial therapy was prescribed in 64.1% of patients, whereas 35.9% received monotherapy. The average number of antimicrobials per prescription was 2.3 (Table 4). The intravenous route was the most frequently used mode of administration, accounting for 92.7% of prescriptions, while oral administration was observed in 7.3% of cases (Table 5).

Microbiological culture and sensitivity testing was performed in 56.8% of patients, while 43.2% received antimicrobial therapy without culture confirmation (Table 6). Evaluation of prescribing practices showed that 61.8% of prescriptions were compliant with standard treatment guidelines, whereas 38.2% were found to be non-compliant, indicating irrational antimicrobial use (Table 7).

Further analysis demonstrated that culture-guided therapy was associated with higher rationality compared to empirical therapy, and this difference was statistically significant ($p = 0.001$) (Table 8).

Table 1: Demographic Characteristics of Study Population (n = 220)

Parameter	Number	Percentage
Male	137	62.3%
Female	83	37.7%

Parameter	Number	Percentage
Mean Age	—	54.6 ± 16.2 years

Table 2: Type of Antimicrobial Therapy

Type of Therapy	Number	Percentage
Empirical therapy	173	78.6%
Culture-guided therapy	47	21.4%

Table 3: Class of Antimicrobials Prescribed

Drug Class	Number	Percentage
Beta-lactams	150	68.2%
Carbapenems	76	34.5%
Glycopeptides	41	18.6%

Table 4: Number of Antimicrobials per Prescription

Parameter	Number	Percentage
Monotherapy	79	35.9%
Combination therapy	141	64.1%
Average number of antimicrobials	—	2.3

Table 5: Route of Administration

Route	Number	Percentage
Intravenous	204	92.7%
Oral	16	7.3%

Table 6: Culture and Sensitivity Testing

Parameter	Number	Percentage
Culture done	125	56.8%
Culture not done	95	43.2%

Table 7: Rationality of Prescriptions

Parameter	Number	Percentage
Rational prescriptions	136	61.8%
Irrational prescriptions	84	38.2%

Table 8: Association between Type of Therapy and Rationality of Prescriptions

Type of Therapy	Rational (n)	Irrational (n)	Total	Result
Empirical therapy	100	73	173	Lower rationality (p = 0.001)
Culture-guided therapy	36	11	47	Higher rationality
Total	**136**	**84**	**220**	—

p = 0.001 (Statistically significant)

Discussion

Antimicrobial prescribing patterns in intensive care units (ICUs) are of critical importance due to the high burden of severe infections and the risk of antimicrobial resistance. In the present study, the majority of patients were males (62.3%) with a mean age of 54.6 ± 16.2 years, which is comparable to findings reported by Satapathy et al. and Patel et al., who observed a predominance of male patients in ICU-based drug utilization studies[9,10]. This may be attributed to higher exposure to risk factors and healthcare-seeking behavior among males.

Empirical antimicrobial therapy was initiated in 78.6% of patients in our study, which is consistent with findings by Anand et al. and Mahajan et al., who also reported a high prevalence of empirical therapy in ICU settings due to the urgency of treatment in critically ill patients[11],[12]. Similar studies have highlighted that empirical use of broad-spectrum antibiotics is common in ICUs, often initiated before microbiological confirmation to reduce mortality risk. However, excessive empirical use contributes significantly to antimicrobial resistance.

The most commonly prescribed antimicrobial class in the present study was beta-lactams (68.2%), followed by carbapenems and glycopeptides. This pattern is in agreement with studies conducted by Williams et al. and Biswal et al., where beta-lactams, particularly cephalosporins and piperacillin-tazobactam, were the most frequently used antibiotics in ICU patients[13],[14]. The frequent use of carbapenems and glycopeptides in our study reflects the increasing concern of multidrug-resistant organisms (MDROs) in critical care settings.

Combination therapy was observed in 64.1% of patients, with an average of 2.3 antimicrobials per prescription. These findings are comparable with those reported by Hedamba et al. and John et al., who also documented high rates of polypharmacy and combination antimicrobial use in ICU settings[15],[16]. The use of combination therapy is often justified in critically ill patients to achieve broad-spectrum coverage; however, it may increase the risk of adverse effects and resistance if not appropriately monitored.

Intravenous administration was used in 92.7% of cases in the present study, which is consistent with findings from recent ICU studies where parenteral administration ranged from 75% to 90% due to the severity of illness and need for rapid drug action[17]. Additionally, microbiological culture testing was performed in only 56.8% of patients, indicating that a significant proportion of patients were treated without culture confirmation. Similar observations were reported by Garg et al., emphasizing the gap between empirical prescribing and culture-guided therapy in ICUs[18].

Assessment of rationality revealed that 38.2% of prescriptions were irrational, which is comparable to studies by Karthik et al. and Naqvi et al., who reported irrational antimicrobial use ranging between 30–40% in ICU settings[19],[20]. Importantly, our study demonstrated that culture-guided therapy was significantly associated with higher rational prescribing, highlighting the importance of microbiological evidence in optimizing antimicrobial use.

The findings of this study emphasize the need for strengthening antimicrobial stewardship programs (ASPs) in ICUs. Previous studies have shown that implementation of stewardship interventions, including prescription audits, guideline adherence, and culture-based therapy, can significantly reduce inappropriate antimicrobial use and improve clinical outcomes[21],[22].

Limitations

The present study has certain limitations. It was conducted in a single tertiary care center with a relatively small sample size, which may limit generalizability. Additionally, detailed microbiological resistance patterns and clinical outcomes were not evaluated. The study also did not assess adherence to defined daily dose (DDD) metrics or cost analysis.

Conclusion

Overall, the findings of this study are consistent with previous research and highlight a high prevalence of empirical and broad-spectrum antimicrobial use in ICU settings. The results underscore the importance of culture-guided therapy and antimicrobial stewardship interventions in improving rational prescribing practices.

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