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Original Article

Antimicrobial Usage Pattern in Critical Care Unit

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ABSTRACT

Background: Drug utilization research was defined in 1977 as the study of the marketing, distribution, prescription, and use of drugs in a society.
Objectives: To identify the utilization pattern of antimicrobials in patients admitted to the critical care unit.
Methods: A cross-sectional, record-based observational study was done in the Critical Care Unit of a tertiary care teaching hospital. Case records of patients of all age groups admitted to the ICU over a period of six months and who received at least one antimicrobial were included. Data were collected from the Medical Records Department and analyzed for 80 patients based on inclusion criteria.
Results: Antimicrobial use was found to be more common among males and in the middle-aged and elderly population. Sepsis and septic shock were the most common indications for antimicrobial therapy, followed by lower respiratory tract infections. Diabetes mellitus and hypertension were most common associated co-morbid conditions. Evaluation of prescriptions using WHO drug utilization indicators showed that a total of 472 drugs were prescribed, of which 186 (39.4%) were antimicrobials. The average number of drugs per patient was 5.9. Among antimicrobials, 34.9% were prescribed by generic name, 88.2% were given as injections, and 92.5% were from the National List of Essential Medicines (2015). Combination antimicrobial therapy was used in most patients.
Conclusion: The findings of this study can provide useful baseline data for promoting rational antimicrobial prescribing and strengthening antimicrobial stewardship practices in critical care settings.

Keywords*: Antimicrobial utilization, WHO drug utilization indicators, Drug utilization study, Essential medicines, Intensive case unit*

INTRODUCTION

Drug utilization research was defined by the World Health Organization (WHO) in 1977 as the study of the marketing, distribution, prescription, and use of drugs in a society.[1] Drug utilization studies are main tools to assess prescribing patterns, identify irrational drug use, and promote rational pharmacotherapy, especially in hospital settings.

Critically ill patients admitted to Intensive Care Units (ICUs) commonly receive multiple medications, among which antimicrobials are a major proportion. The ICU environment is characterized by severe infections, invasive procedures, immunocompromised states, and high antibiotic pressure. All these can contribute to increased antimicrobial consumption.[2] Common infections seen in ICUs include ventilator-associated pneumonia, bloodstream infections, urinary tract infections, intra-abdominal infections, skin and soft tissue infections, and sepsis of unknown origin.[3]

Globally, antimicrobial consumption has increased recently. Between 2000 and 2015, antibiotic use increased by more than 65%. Low- and middle-income countries contributed significantly to this rise.[4] India is one of the largest consumers of antibiotics, raising serious concerns about antimicrobial resistance (AMR).[5] Excessive and inappropriate antimicrobial use in ICUs accelerates the emergence of multidrug-resistant organisms, increases treatment costs, prolongs hospital stay, and worsens patient outcomes. [6]

WHO and other international bodies stress on rational antimicrobial use through stewardship programs, prescription audits, and drug utilization studies.[7] Evaluating antimicrobial prescribing patterns using WHO drug utilization indicators provides objective data to assess current practices and identify areas requiring intervention.

Objectives

1. To assess the antimicrobial utilization pattern in patients admitted to the critical care unit using WHO drug utilization indicators.
2. To know the demographic profile and clinical indications for antimicrobial use.
3. To study the prevalence of associated co-morbid conditions among ICU patients receiving antimicrobials.

MATERIALS AND METHODS

Study Design and Setting

This was a cross-sectional, record-based, observational study conducted in the Critical Care Unit of a tertiary care teaching hospital.

Study Duration

Data were collected for a period of 6 months from medical records of ICU patients. Done from May 2025 to November 2025.

Inclusion Criteria

- Case records of patients of all age groups admitted to the ICU
- Patients who received at least one antimicrobial agent during ICU stay

Exclusion Criteria

- Case records with incomplete drug or clinical data
- Patients with ICU stay less than 24 hours

Sample Size

Based on the average monthly ICU admissions and feasibility considerations, a sample size of 80 patients was selected for analysis.

Sampling Technique

Systematic random sampling method was adopted, wherein every alternate eligible ICU case record was included until the required sample size was achieved.

Data Collection

Data were collected using a pre-designed structured proforma, which included:

- Demographic details
- Primary diagnosis and indication for antimicrobial therapy
- Details of antimicrobials prescribed (drug name, dose, route, duration)
- Associated co-morbid conditions

Drug Utilization Analysis

Antimicrobial usage was analyzed using WHO drug utilization indicators.

1. Average number of drugs prescribed per patient
2. Percentage of encounters with antimicrobials prescribed
3. Percentage of antimicrobials prescribed by generic name
4. Percentage of antimicrobial injections prescribed
5. Percentage of antimicrobials prescribed from the National List of Essential Medicines (NLEM).

Statistical Analysis

Data were entered into Microsoft Excel and analyzed using descriptive statistics. Results were expressed as numbers, percentages, and mean ± standard deviation (SD). No inferential statistical tests were applied.

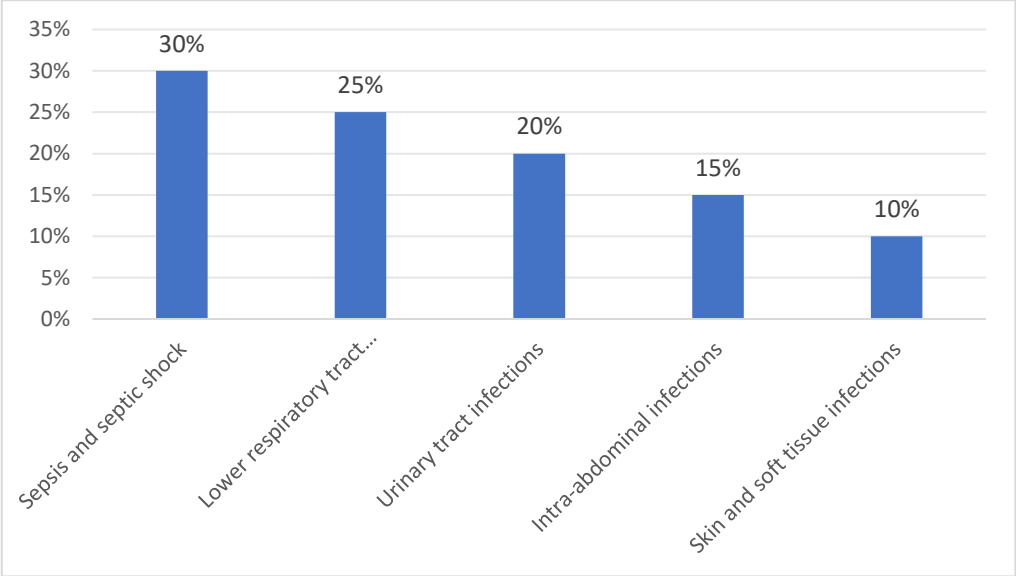
RESULTS

Demographic Profile

80 ICU patient records were analyzed. The age of patients ranged from 18 to 82 years. Mean age was 46.2 ± 15.8 years. Most patients were in the 41–60 years age group. Male patients (52, 65%) are more than female patients (28, 35%).

Clinical Indications for Antimicrobial Use

The most common indications for antimicrobial therapy were:



Graph 1: Clinical indicatons for antimicrobial usage

Drug Prescribing Pattern

472 drugs were prescribed to 80 patients, out of which 186 were antimicrobials.

WHO Drug Utilization Indicators:

Table 2: Antimicrobial usage pattern seen

Indicator	**Result**
Average number of drugs per patient	5.9
Percentage of antimicrobials among total drugs	39.4%
Percentage of antimicrobials prescribed by generic name	34.9%
Percentage of antimicrobial injections	88.2%
Percentage from NLEM list	92.5%

Most commonly used antimicrobials:

The most commonly prescribed antimicrobials were:

Antimicrobial agent	Percentage (%)
Ceftriaxone	30%
Piperacillin–tazobactam	25%
Metronidazole	20%
Meropenem	15%
Amikacin	10%
Total	100%

Combination antimicrobial therapy was used in 68% of patients. Antimicrobial modification based on culture sensitivity reports was observed in 29 patients (36.3%).

Associated Co-morbid Conditions

Table 3: Comorbidities seen among patients

Co-morbidity	**Number of patients**
Diabetes Mellitus	32
Hypertension	26
Chronic kidney disease	11
No co-morbidities	21

Diabetes mellitus was the most common associated co-morbidity.

DISCUSSION

The present study evaluated antimicrobial usage patterns among critically ill patients using WHO drug utilization indicators. The predominance of male patients and middle-aged adults in ICU admissions is consistent with previous Indian and international studies.[8-11]

Antimicrobials constituted nearly 40% of all prescribed drugs. This shows high burden of infections in ICU settings. Similar findings were reported in other ICU-based drug utilization studies.[12,13] Broad-spectrum antimicrobials like ceftriaxone and piperacillin–tazobactam were commonly prescribed.

Sepsis and septic shock were common indications for antimicrobial therapy (30%), followed by lower respiratory tract infections including ventilator-associated pneumonia (25%). This distribution is similar with findings from the multicenter EPIC II study, which identified sepsis and respiratory tract infections as the leading causes of infection and antimicrobial use in intensive care units worldwide.[2] These patterns have also been reported in Indian ICU-based studies, where sepsis is the main indication for empirical antimicrobial therapy due to its high morbidity and mortality.[14,15]

The antimicrobial utilization pattern in the present study showed more antimicrobial burden, with antimicrobials accounting for 39.4% of total drugs prescribed and an average of 5.9 drugs per patient. Comparable levels of antimicrobial use and polypharmacy have been reported in previous ICU drug utilization studies.[15],[16] The predominance of injectable antimicrobials (88.2%) is similar with standard ICU practice and is consistent with earlier reports documenting injectable use exceeding 80%[17]. Ceftriaxone and piperacillin–tazobactam were the most commonly prescribed antimicrobials, a trend commonly seen in ICU settings due to their broad-spectrum coverage and suitability for empirical therapy.[2] Combination antimicrobial therapy was used in 68% of patients;but antimicrobial modification based on culture sensitivity was observed in only 36.3% of patients. This shows continued reliance on empirical therapy, as reported in other studies, and showing the need for strengthened antimicrobial stewardship and timely de-escalation practices. [16-17]

Evidence suggests that interventions such as antibiotic restriction policies, adherence to treatment guidelines, and biomarker-guided therapy can significantly reduce inappropriate antimicrobial use.[18]

Generic prescribing was lower than the WHO ideal of 100%, indicating scope for improvement. Encouragingly, most antimicrobials were prescribed from the National List of Essential Medicines, reflecting rational selection practices.
The present study shows high utilization of antimicrobials in the critical care unit, with common use of broad-spectrum and injectable agents. Though most antimicrobials were prescribed from the National List of Essential Medicines, the relatively lower proportion of generic prescribing highlights the need for improved adherence to rational prescribing practices. Regular drug utilization reviews and strengthening of antimicrobial stewardship programs are essential to optimize antimicrobial use and limit the emergence of antimicrobial resistance in critical care settings.[14]

Limitations

- Single-center study with limited sample size
- Short study duration
- Pharmacoeconomic analysis was not performed

Conclusion

The present study assessed the antimicrobial utilization pattern using WHO drug utilization indicators. The study found high burden of antimicrobial usage in ICU with frequent prescription of broad-spectrum and injectable agents. Though the majority of antimicrobials were prescribed from the National List of Essential Medicines, generic prescribing was relatively low and combination therapy was commonly used, with limited culture-guided modification. These findings show the need for regular drug utilization audits and strengthening antimicrobial stewardship programs to promote rational antimicrobial use, reduce antimicrobial resistance.

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