Section: Pharmacology

Original Research Article

ANTIBIOTICS USAGE PATTERN IN INTENSIVE MEDICAL CARE UNIT AT TERTIARY CARE HOSPITAL IN TAMIL NADU

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ABSTRACT

Background: Antibiotics are among the most frequently prescribed drugs in intensive care settings, where empirical broad-spectrum therapy is often started early to manage life-threatening infections. Irrational and prolonged antibiotic use increases treatment cost and drives antimicrobial resistance, yet data on antibiotic prescribing patterns in Intensive Medical Care Units (IMCU) of Indian tertiary care hospitals remain limited. This study aimed to monitor the usage pattern of antibiotics in an IMCU of a tertiary care hospital in Tamil Nadu. **Materials and Methods:** An observational, hospital-based drug-utilisation study was conducted in the IMCU of Kanyakumari Government Medical College and Hospital, Asaripallam, over a two-month period. All patients admitted for a minimum of 72 hours and receiving systemic antibiotic therapy were included. Demographic details, clinical indication, antimicrobial agents prescribed, route of administration and adverse drug reactions were recorded on a standard proforma and analysed using SPSS; means and frequencies were computed for all study variables. **Result:** Of the 100 patients studied, 65% were male and 40% were in the 41–60-year age group. Poisoning (24%), COPD (16%), septicemia (12%) and chronic kidney disease (12%) were the leading admission diagnoses. Single-antibiotic therapy was prescribed in 45% of patients, two antibiotics in 26%, three in 19%, and four to five antibiotics in 10%. Ceftriaxone was the most frequently prescribed antibiotic, used in 94% of patients, followed by metronidazole (21%), piperacillin (19%) and ciprofloxacin (13%). The parenteral route (72%) was preferred over the oral route (28%). **Conclusion:** Antibiotics, particularly ceftriaxone, are extensively and often empirically prescribed in the IMCU, frequently as combination therapy administered parenterally. While polypharmacy is often clinically justified in critically ill patients, continued antibiotic-utilisation surveillance and a strict institutional antibiotic policy are needed to promote rational prescribing and curb antimicrobial resistance.

INTRODUCTION

Antibiotics are pharmacological agents that kill or inhibit the growth of bacteria, and they remain indispensable in the management of infections encountered in critical care.[1] Patients admitted to the intensive medical care unit (IMCU) are frequently started on more than one broad-spectrum antibiotic on the very first day of admission, since they are often in life-threatening states, have undergone multiple invasive procedures, and are at higher risk of exposure to drug-resistant organisms. Irrational antibiotic use in this setting not only escalates treatment cost but also compounds the growing burden of antimicrobial resistance and associated health hazards.[2,3] It was against this background that the present study was undertaken to analyse the prescribing pattern of antibiotics in the IMCU of a tertiary care hospital, and to document the most frequently used antibiotics and their route of administration, so as to evaluate the appropriateness of antibiotic use in this setting.

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Prescribing of antibiotics in critical care is often empirical, guided by the likely causative organism and by individual physician experience, a practice that can, at times, lead to overuse.[4-6] There is mounting evidence that drug-resistant Enterobacteriaceae are acquiring resistance even to carbapenems and colistin, agents that are conventionally reserved for multidrug-resistant Gram-negative organisms.[7,8] Inappropriate prescribing for trivial, self-limiting illnesses, such as the common cold, or self-medication for loose stools and fever, is an important contributor to the emergence of antimicrobial resistance in the community.[3] Polypharmacy, misuse of injectable antibiotics, over-the-counter dispensing without a valid prescription, and premature discontinuation of therapy are widely recognised as common causes of irrational antibiotic use. The World Health Organization has defined inappropriate antimicrobial use as the use of an improper dosage form, or a duration that is either too short or too long, both of which increase the risk of resistance emerging.[2-4]

Antibiotics are the most frequently used class of drugs in intensive care units worldwide, yet published data describing their utilisation pattern, particularly from Indian tertiary care IMCUs, remain scarce. Periodic evaluation of antibiotic prescribing is therefore essential, both to improve efficacy and safety of therapy and to guard against the emergence of resistance.[2] Information generated through such drug-utilisation studies can additionally serve as the evidence base for formulating an institution-specific antibiotic policy. The IMCU, being a high-antibiotic-exposure area, is a particularly important setting in which to gather this information.[9,10]

In the Indian context, the problem of antimicrobial resistance is further compounded by the widespread availability of antibiotics without a valid prescription, variable adherence to standard treatment guidelines across institutions, and the absence, in many hospitals, of a formal antimicrobial stewardship programme or a functioning hospital infection-control committee. National guidelines have repeatedly emphasised the need for local, hospital-specific antibiograms and antibiotic policies rather than reliance on generic national or international recommendations, since the pattern of prevalent organisms and their susceptibility varies considerably between institutions and even between units within the same hospital3. The intensive care unit, by virtue of its high antibiotic consumption density, invasive device use and the vulnerability of its patient population, is widely regarded as a key sentinel site for surveillance of both antibiotic use and the emergence of resistant organisms. Systematic, periodic drug-utilisation studies of the kind undertaken here therefore have direct relevance not only to individual patient care but also to the broader institutional and public-health effort to contain antimicrobial resistance.

Aim: To monitor the usage pattern of antibiotics in an Intensive Medical Care Unit of a tertiary care hospital in Tamil Nadu.

MATERIALS AND METHODS

Study Design and Setting: This was a hospital-based, observational, prospective drug-utilisation study carried out in the Intensive Medical Care Unit (IMCU) of Kanyakumari Government Medical College and Hospital, Asaripallam, Tamil Nadu.

Study Population: All patients admitted to the IMCU for a minimum period of 72 hours and who received systemic antibiotic therapy during their stay were eligible for inclusion in the study.

Study Period: Data were collected over a period of two months, from 1 June 2021 to 30 July 2021, following approval from the Institutional Ethics Committee.

Inclusion Criteria

Patients who received one or more antibiotics during their stay in the IMCU were included.

Exclusion Criteria

Patients who were not administered any antibiotic during their IMCU stay were excluded from the study.

Study Procedure: After obtaining clearance from the Institutional Ethics Committee, data collection was carried out prospectively in the IMCU using a standard, pre-tested clinical record proforma comprising two sections. Section one captured demographic details, including the patient's name, age, sex, weight, diagnosis and date of admission. Section two recorded the clinical indication for antimicrobial therapy, the antimicrobial agent(s) selected, the route of administration, and any adverse drug reactions attributable to the antibiotics prescribed. Data were also collected on the duration of antibiotic therapy and relevant infection-related investigations that guided the choice of therapy.

Statistical Analysis: Data were entered and analysed using the Statistical Package for Social Sciences (SPSS). Descriptive statistics, means and frequencies, were computed to derive the percentage distribution of all study variables, including the number of antibiotics prescribed per patient, the individual antibiotic agents used, and the route of administration.

RESULTS

This study monitored the antibiotic-prescribing pattern of 100 patients admitted to the IMCU over a period of two months. Age distribution showed that 7% of patients were aged 10–20 years, 21% were 21–40 years, 40% were 41–60 years, 30% were 61–80 years, and 2% were 81–100 years, indicating that the middle-aged and elderly groups together accounted for the great majority of admissions. Of the 100 patients, 65% were male and 35% were female.

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Poisoning was the single leading cause of admission (24%), followed by COPD (16%), septicemia (12%), chronic kidney disease (12%), acute pulmonary edema/LVF (10%), metabolic encephalopathy (10%), cerebrovascular accident/stroke (8%), seizure (5%) and snake bite (3%) [Table 1, Figure 1].

With regard to the route of administration, the parenteral route was preferred in 72% of prescriptions, while the oral route was used in the remaining 28%. Regarding the number of antibiotics prescribed per patient, 45% received a single antibiotic, 26% received two antibiotics, 19% received three antibiotics, and 10% received four to five antibiotics during their IMCU stay [Table 2, Figure 2].

Ceftriaxone was by far the most frequently prescribed antibiotic, used in 94% of the 100 patients, followed by metronidazole (21%), piperacillin (19%), ciprofloxacin (13%), azithromycin and rifaximin (8% each), doxycycline (5%), penicillin (4%), and linezolid and vancomycin (3% each) [Table 3]. As patients commonly received more than one agent, these figures do not sum to 100%. The high proportion of patients receiving ceftriaxone reflects its routine use as first-line, broad-spectrum empirical cover on admission, with the remaining agents added according to the specific clinical indication, suspected source of infection, or as second-line/reserve cover.

An important limitation of this study is that only the antibiotic prescriptions recorded at the time of admission were audited; prescriptions modified later during the course of ICU stay, and clinical outcomes such as length of stay or mortality, were not captured.

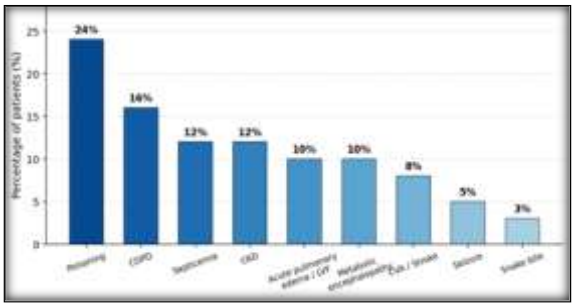

Figure 1: Distribution of Admission Diagnoses in the IMCU (n = 100)

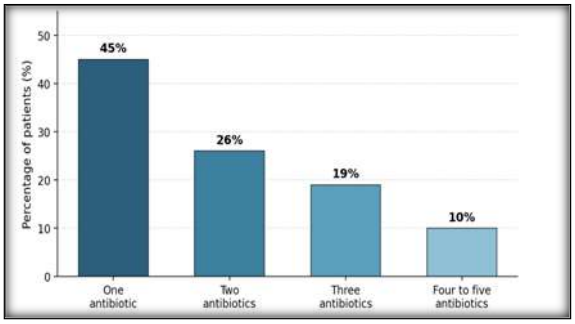

Figure 2: Distribution of the Number of Antibiotics Prescribed per Patient in the IMCU (n = 100)

Table 1: Demographic and Clinical Characteristics of the Study Population (n = 100)

Characteristic	Category	n (%)
Age group (years)	10–20	7 (7%)
	21–40	21 (21%)
	41–60	40 (40%)
	61–80	30 (30%)
	81–100	2 (2%)
Sex	Male	65 (65%)
	Female	35 (35%)
Admission diagnosis	Poisoning	24 (24%)
	COPD	16 (16%)
	Septicemia	12 (12%)
	Chronic kidney disease	12 (12%)
	Acute pulmonary edema / LVF	10 (10%)
	Metabolic encephalopathy	10 (10%)
	Cerebrovascular accident / stroke	8 (8%)
	Seizure	5 (5%)
	Snake bite	3 (3%)

Table 2: Antibiotic Utilisation Pattern in the IMCU: Route of Administration and Number of Antibiotics per Patient (n = 100)

Parameter	Category	n (%)
Number of antibiotics per patient	One	45 (45%)
	Two	26 (26%)
	Three	19 (19%)
	Four to five	10 (10%)
Route of administration	Parenteral	72 (72%)
	Oral	28 (28%)

Table 3: Most Frequently Prescribed Antibiotics in the IMCU (n = 100)

Antibiotic	Number of patients	Percentage
Ceftriaxone	94	94%
Metronidazole	21	21%
Piperacillin	19	19%

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Ciprofloxacin	13	13%
Azithromycin	8	8%
Rifaximin	8	8%
Doxycycline	5	5%
Penicillin	4	4%
Linezolid	3	3%
Vancomycin	3	3%

DISCUSSION

Antibiotics are lifesaving drugs, and in this study more than half of the patients (55%) received two or more antibiotics concurrently. Although this pattern constitutes polypharmacy, it cannot in itself be labelled an irrational practice, since empirical combination therapy is frequently necessary until a definitive microbiological diagnosis is established, and multiple-drug regimens are often essential for the management of acute, life-threatening conditions. Furthermore, patients admitted to the IMCU frequently present with more than one active disease process, and treating each of these conditions adequately may itself necessitate the use of more than one antimicrobial agent.

The finding that ceftriaxone was prescribed to 94% of patients, far ahead of any other agent, is consistent with the wide empirical use of third-generation cephalosporins reported in other Indian intensive care drug-utilisation studies, where cephalosporins, fluoroquinolones and nitroimidazoles similarly dominate the prescription pattern in the initial, empirical phase of therapy.[9,10] The predominance of the parenteral route observed in this study (72%) is expected in a critical-care setting, where oral intake is often compromised and rapid, reliable systemic drug levels are required; similar parenteral predominance has been documented in other ICU-based utilisation audits.[5,6]

Poisoning, the leading cause of IMCU admission in this study (24%), together with COPD and septicemia, are conditions in which either prophylactic antibiotic cover (for example, aspiration risk following poisoning or altered consciousness) or definitive treatment of an established or suspected infective process is commonly indicated, which may partly explain the very high proportion of patients started on ceftriaxone irrespective of the primary diagnosis. This pattern of near-universal empirical cephalosporin cover, while pragmatic in a resource-limited critical-care setting, also represents a significant selective pressure favouring the emergence of cephalosporin-resistant organisms if not accompanied by timely review and de-escalation once culture and sensitivity reports become available.

The use of broad-spectrum combination regimens, including reserve or second-line agents such as vancomycin and linezolid in a small proportion of patients, reflects standard clinical practice of covering both Gram-positive and Gram-negative organisms in critically ill patients while awaiting definitive microbiological results. However, this same practice of broad-spectrum empirical therapy is also the one most closely linked, in the wider literature, to the selective pressure that drives the emergence of carbapenem- and colistin-resistant Enterobacteriaceae, organisms of last-resort concern in critical care.[7,8] This underscores the importance of timely de-escalation of therapy once culture reports become available, a step that could not be captured in the present study, since only prescriptions recorded at the time of admission were audited.

Taken together, these findings reaffirm the WHO's caution that inappropriate dosage, duration and route of antimicrobial therapy are important drivers of resistance, and highlight the continued need for institution-specific antibiotic policies, supported by periodic drug-utilisation audits of the kind reported here, to guide rational prescribing in the IMCU.[2-4]

The present findings should be interpreted in light of certain limitations. First, the sample was drawn from a single IMCU over a relatively short period of two months, which may limit the generalisability of the findings to other units or seasons. Second, since only the prescriptions recorded at the time of admission were audited, changes in antibiotic therapy made later in the course of the ICU stay, such as escalation, de-escalation, or discontinuation guided by culture and sensitivity reports, were not captured, and the true overall antibiotic exposure of each patient may therefore have been under- or over-estimated. Third, clinical outcome data, such as length of ICU stay, mortality, or resolution of infection, were not correlated with the prescribing pattern in this study, and such correlation would be valuable in future work. Despite these limitations, the study provides a useful baseline description of antibiotic prescribing in this institution and highlights specific, actionable targets, such as timely culture-guided de-escalation of ceftriaxone-based empirical regimens, for future stewardship interventions.

CONCLUSION

The present study reveals that antibiotics are unavoidable drugs that are widely prescribed to critically ill patients and constitute a significant proportion of the total drugs consumed in the IMCU. Polypharmacy with antibiotics may often be clinically essential in the treatment of patients admitted to the IMCU, particularly those with septicemia and other severe infective conditions. Nonetheless, rational use of antimicrobial agents in the IMCU should be actively encouraged through strict adherence to an institutional antibiotic policy, supported by periodic prescription audits and antimicrobial stewardship activities. A limitation of

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the present study is that only the drug prescriptions recorded at the time of admission were audited; prospective, longitudinal audits capturing the entire course of therapy are recommended for future research.

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