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Original Article

Analysis of Prescription Pattern and Adverse Drug Reaction of Drugs in Medicine Intensive Care Unit, LLR Hospital, GSVM Medical College, Kanpur

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ABSTRACT

Background: Critically ill patients admitted to intensive care units are frequently exposed to multiple medications, increasing the risk of polypharmacy, irrational prescribing, and adverse drug reactions (ADRs). Evaluation of prescription patterns and ADRs is essential for promoting rational drug use and improving patient safety.
Objectives: To analyse the prescription pattern and adverse drug reactions of drugs used in the Medicine Intensive Care Unit (MICU) of LLR Hospital, G.S.V.M. Medical College, Kanpur.
Materials and Methods: A prospective observational study was conducted among 226 patients admitted to the MICU. Data regarding demographic characteristics, prescribed medications, route of administration, and ADRs were collected and analysed. Prescribing patterns were evaluated using WHO prescribing indicators. ADR causality and severity were assessed using Naranjo's Causality Assessment Scale and the Modified Hartwig and Siegel Severity Assessment Scale, respectively.
Results: The majority of patients belonged to the 41–60 years age group (33.6%), and males constituted 56.2% of the study population. A total of 1,936 drugs were prescribed, with an average of 8.57 drugs per encounter. Generic prescribing accounted for 55.9% of prescriptions, while 92.3% of drugs were prescribed from the Essential Drug List. Antibiotics were the most commonly prescribed drug class (26.14%), and all patients received at least one injectable medication. Polypharmacy was common, with 69.0% of patients receiving 5–9 drugs per encounter. Ten ADRs were reported, yielding an incidence of 4.42%. Most ADRs were mild in severity, and 90% were categorized as "possible" according to Naranjo's Scale.
Conclusion: The study revealed a high prevalence of polypharmacy and extensive antibiotic use among MICU patients. Although adherence to the Essential Drug List was satisfactory, generic prescribing remained suboptimal. Continuous prescription monitoring, rational antibiotic use, and strengthened pharmacovigilance activities are necessary to improve medication safety and promote rational drug utilization in intensive care settings.

Keywords*: Prescription pattern, Intensive care unit, Polypharmacy, WHO prescribing indicators, Pharmacovigilance.*

INTRODUCTION

Rational use of medicines is an essential component of quality healthcare. According to the World Health Organization (WHO), rational prescribing requires that patients receive medications appropriate to their clinical needs, in doses that meet

their individual requirements, for an adequate duration, and at the lowest possible cost to them and their community.[1] Irrational prescribing practices can lead to polypharmacy, increased healthcare costs, adverse drug reactions (ADRs), antimicrobial resistance, and poor therapeutic outcomes.[2]

The Intensive Care Unit (ICU) represents a unique healthcare setting where critically ill patients require intensive monitoring and complex pharmacological management. Patients admitted to ICUs often suffer from multiple comorbidities and life-threatening conditions requiring simultaneous administration of several medications.[3] Consequently, polypharmacy is highly prevalent in ICUs and increases the risk of drug-drug interactions, medication errors, and adverse drug reactions.[4]

Drug utilization studies are important tools for evaluating prescribing patterns and assessing the rationality of drug use in healthcare institutions. Such studies help identify areas of inappropriate prescribing and provide evidence for developing strategies to improve medication use.[5] The WHO has developed standardized prescribing indicators to assess prescription practices, including average number of drugs per encounter, percentage of drugs prescribed by generic name, percentage of encounters with antibiotics and injections prescribed, and percentage of drugs prescribed from the Essential Drug List (EDL).[6]

Antibiotics constitute one of the most frequently prescribed classes of drugs in ICUs due to the high incidence of severe infections, sepsis, and hospital-acquired infections. However, excessive or inappropriate antibiotic use contributes significantly to the emergence of antimicrobial resistance, which has become a major global public health concern.[7] Monitoring antibiotic utilization patterns is therefore essential for promoting antimicrobial stewardship and rational prescribing practices.[8]

Adverse drug reactions are another major concern in critically ill patients. The incidence of ADRs is generally higher in ICUs because of multiple drug exposure, altered pharmacokinetics, organ dysfunction, and prolonged hospitalization.[9] ADRs may increase morbidity, mortality, length of hospital stay, and healthcare expenditure.[10] Therefore, systematic monitoring and assessment of ADRs are vital components of patient safety programs.

Various tools have been developed for ADR assessment. The Naranjo Adverse Drug Reaction Probability Scale is widely used to determine the causal relationship between a drug and an observed adverse event.[11] Similarly, the Modified Hartwig and Siegel Severity Assessment Scale is commonly employed to classify the severity of ADRs.[12]

Studies evaluating prescription patterns and ADRs in ICU settings provide valuable information regarding drug utilization trends, prescribing behavior, and medication safety. Such information can help healthcare professionals optimize pharmacotherapy, reduce preventable ADRs, and improve overall patient outcomes.[13,14]

Therefore, the present study was undertaken to analyze the prescription pattern and adverse drug reactions associated with drugs used in the Medicine Intensive Care Unit of LLR Hospital, G.S.V.M. Medical College, Kanpur.

MATERIALS AND METHODS

Study Design and Setting

This prospective observational study was conducted in the Department of Pharmacology in collaboration with the Department of Medicine at G.S.V.M. Medical College, Kanpur, and its associated hospitals. The study was carried out among patients admitted to the Medicine Intensive Care Unit (ICU) to evaluate prescribing patterns and adverse drug reactions (ADRs).

Study Population

All patients admitted to the Medicine ICU during the study period who fulfilled the inclusion criteria were enrolled. Patient demographic details, clinical diagnosis, medication history, and treatment details were collected from Bed Head Ticket (BHT) records and patient case files.

Inclusion criteria:

- Patient's age >18 years
- Patients admitted to the Medicine ICU for more than 24 hours.

Exclusion criteria:

- Patient's age <18 years
- Patient admitted to Medicine ICU for <24 hours.
- Patients admitted for post operative care.

Sample Size
Sample size calculation : The sample size is calculated by Taro Yamane's formula

$$n = \frac{N}{1 + N(e)2}$$

Where n – sample size
N- population size
e- probable error
Sample size = 226

Data Collection
Data were collected using a structured patient profile data collection form. Information recorded included demographic characteristics, provisional diagnosis, indications for prescribed medications, number of drugs prescribed on admission, dosage, route of administration, and pharmacological class of medications. Prescriptions were reviewed periodically throughout the ICU stay.

Assessment of Prescribing Pattern
Prescribing practices were evaluated using the World Health Organization (WHO) Prescribing Indicators. Completeness of prescription writing was assessed based on the presence of:

- Generic or brand name of the drug
- Dose
- Frequency of administration
- Route of administration
- Date of prescription
- Signature of the prescriber

WHO Prescribing Pattern Indicators
Prescribing patterns were evaluated using the **WHO Prescribing Indicators**, which included:

- Average number of drugs prescribed per encounter
- Percentage of drugs prescribed by generic name
- Percentage of encounters with antibiotics prescribed
- Percentage of encounters with injections prescribed
- Percentage of drugs prescribed from the Essential Drug List (EDL) or hospital formulary

Adverse Drug Reaction Monitoring
Patients were monitored for the occurrence of adverse drug reactions during their ICU stay. Suspected ADRs were documented using a standardized ADR reporting form.

Causality and Severity Assessment
The causality of reported ADRs was assessed using the Naranjo Adverse Drug Reaction Probability Scale. Severity assessment was performed using the Modified Hartwig and Siegel Severity Assessment Scale.

Study Tools
The following tools were used during the study:

- Bed Head Ticket (BHT) records
- Patient profile data collection form
- ADR reporting form
- Naranjo ADR Probability Scale
- Modified Hartwig and Siegel Severity Assessment Scale
- WHO Prescribing Indicators
- WHO Drug Use Indicators

Pilot Study
A pilot study was conducted prior to the main study to assess the feasibility of the study design and data collection tools. Necessary modifications were incorporated based on the observations obtained during the pilot phase.

Validity and Reliability
The study instruments were reviewed and validated by experts from the Departments of Pharmacology and Medicine. Standardized data collection forms and internationally accepted assessment scales were employed to ensure reliability and consistency of data collection.

Ethical Considerations

Ethical approval for the study was obtained from the Institutional Ethics Committee of G.S.V.M. Medical College, Kanpur, prior to commencement of the study. Written informed consent was obtained from all participants or their legally authorized representatives. Confidentiality and anonymity of patient information were maintained throughout the study.

Statistical Analysis

Data were entered into Microsoft Excel and analyzed using appropriate statistical methods. Descriptive statistics were used to summarize the findings. Results were expressed as frequencies, percentages, means, and standard deviations wherever applicable.

RESULT AND OBSERVATIONS

Table 1. Age-wise Distribution of Study Patients (n = 226)

Age Group (Years)	Number of Patients (n)	Percentage (%)
18–40	72	31.8
41–60	76	33.6
61–80	65	28.8
>80	13	5.8
Total	226	

Among the 226 study patients, the 41–60 years age group constituted the largest proportion (33.6%), followed by the 18–40 years (31.8%) and 61–80 years (28.8%) age groups. Patients aged >80 years accounted for the smallest proportion (5.8%), indicating that most patients were middle-aged to elderly adults.

Table 2. Gender Distribution of Study Patients (n = 226)

Gender	Number of Patients (n)	Percentage (%)
Male	127	56.2
Female	99	43.8
Total	226	100.0

Out of the 226 study patients, 127 (56.2%) were males and 99 (43.8%) were females. This indicates a slight male predominance among the patients included in the study.

Table 3. Average Number of Drugs per Encounter/Prescription

Parameter	Value
Total number of patients	226
Total number of drugs prescribed	1936
Average number of drugs per encounter	8.57

A total of 1936 drugs were prescribed to 226 patients, resulting in an average of 8.57 drugs per encounter/prescription. This indicates a relatively high number of medications prescribed per patient, suggesting the presence of polypharmacy in the study population.

Table 4. Generic and Brand Name Prescribing Pattern

Parameter	Number (n)	Percentage (%)
Drugs prescribed by generic name	1083	55.9
Drugs prescribed by brand name	853	44.1
Total drugs prescribed	1936	100.0

Out of the 1936 drugs prescribed, 1083 (55.9%) were prescribed by their generic names, while 853 (44.1%) were prescribed by brand names. This indicates that generic prescribing was more common than brand-name prescribing in the study population.

Table 5. Antibiotic Prescribing Pattern

Parameter	Value
Total number of drugs prescribed	1936
Total antibiotics prescribed	506
Percentage of total drugs that were antibiotics	26.14%
Percentage of encounters with antibiotics prescribed	100%
Average number of antibiotics per encounter	2.14

Out of the 1936 drugs prescribed, 506 (26.14%) were antibiotics. Antibiotics were prescribed in all encounters (100%), with an average of 2.14 antibiotics per encounter, indicating extensive use of antibiotics among the study patients.

Table 6. Class-wise Distribution of Drugs

Drug Class	Frequency (n)	Percentage (%)
Antibiotics	506	26.14
Proton Pump Inhibitors	205	10.60
Antiemetics	202	10.40
Supplements	126	6.50
Laxatives	108	5.60
Corticosteroids	97	5.20
Diuretics	82	4.20
NSAIDs	60	3.10
Others	550	28.40
Total	1936	100.0

Among the 1936 drugs prescribed, antibiotics were the most commonly prescribed drug class (26.14%), followed by proton pump inhibitors (10.60%) and antiemetics (10.40%). The 'Others' category accounted for the largest overall share (28.40%), reflecting the diverse range of medications used in the study population.

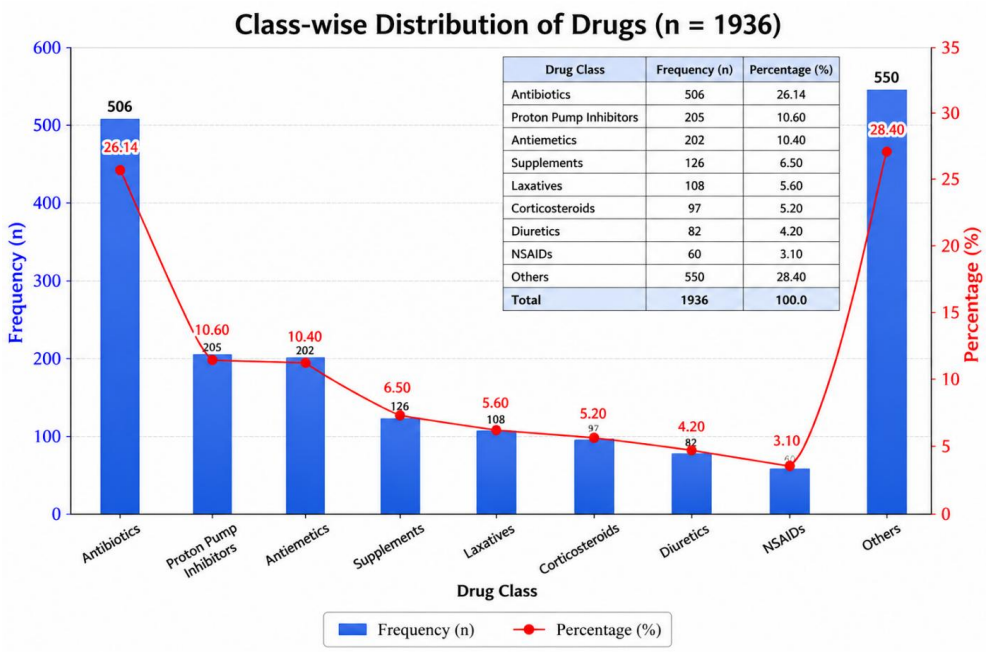

Table 7. Route of Administration of Prescribed Drugs

Route of Administration	Frequency (n)	Percentage (%)
Intravenous (IV)	1398	72.21
Oral	493	25.46
Subcutaneous (SC)	32	1.65
Others	13	0.67
Total	1936	100.0

The intravenous (IV) route was the most commonly used route of drug administration, accounting for 72.21% of all prescribed drugs, followed by the oral route (25.46%). Subcutaneous (1.65%) and other routes (0.67%) were used less frequently, reflecting the predominance of parenteral therapy in the ICU setting.

Table 8. Polypharmacy Distribution

Number of Drugs per Encounter	Percentage (%)
<5 Drugs	2.2
5–9 Drugs	69.0
≥10 Drugs	28.8
Total	100.0

Most patients (69.0%) received 5–9 drugs per encounter, while 28.8% received 10 or more drugs, indicating a high prevalence of polypharmacy. Only 2.2% of patients were prescribed fewer than 5 drugs.

Table 9. WHO Prescribing Indicators

WHO Prescribing Indicator	Observed Value
Average number of drugs per encounter	8.57
Percentage of drugs prescribed by generic name	55.9%
Percentage of encounters with antibiotics prescribed	100%
Percentage of encounters with injections prescribed	100%
Percentage of drugs prescribed from Essential Drug List (EDL)	92.3%

The WHO prescribing indicators showed an average of 8.57 drugs per encounter, with 55.9% of drugs prescribed by generic name. Antibiotics and injections were prescribed in 100% of encounters, while 92.3% of drugs were prescribed from the Essential Drug List (EDL), indicating high adherence to essential medicine prescribing.

Table 10. Adverse Drug Reactions and System-wise Distribution (n = 10)
A. Type-wise Distribution of ADRs

Adverse Drug Reaction	Frequency (n)	Percentage (%)
Gastrointestinal disorders	2	20
Skin reactions	2	20
Nausea	1	10
Sedation	1	10
Drowsiness	1	10
Dizziness	1	10
Metallic taste	1	10
Others	1	10
Total	10	100.0

A total of 10 adverse drug reactions (ADRs) were reported during the study. Gastrointestinal disorders and skin reactions were the most common ADRs, each accounting for 20% of cases, while nausea, sedation, drowsiness, dizziness, metallic taste, and other reactions each contributed 10% of the reported ADRs.

B. System-wise Distribution of ADRs

System Involved	Frequency (n)	Percentage (%)
Central & Peripheral Nervous System Disorders	3	30
Gastrointestinal Disorders	3	30
Dermatological Disorders	2	20
Others	2	20
Total	10	100.0

The central and peripheral nervous system disorders and gastrointestinal disorders were the most commonly affected systems, each accounting for 30% of the reported ADRs. Dermatological disorders and other system-related reactions contributed 20% each of the total ADRs reported.

DISCUSSION

The present study evaluated prescription patterns and adverse drug reactions among patients admitted to the Medicine Intensive Care Unit of a tertiary care teaching hospital. Drug utilization studies conducted in ICU settings are particularly important because critically ill patients are frequently exposed to multiple medications and are at increased risk of adverse drug events.

In the present study, the majority of patients belonged to the 41–60 years age group (33.6%), followed by the 61–80 years age group (28.8%). Similar findings have been reported by previous investigators, who observed that ICU admissions are more common among middle-aged and elderly patients due to the higher prevalence of chronic illnesses and comorbid conditions in these age groups.[15,16]

Male patients constituted 56.2% of the study population, indicating a male predominance in ICU admissions. Comparable gender distributions have been reported in several ICU-based drug utilization studies conducted in India and abroad.[17,18]

The average number of drugs prescribed per encounter was 8.57, reflecting a high degree of polypharmacy. Polypharmacy is a common phenomenon in ICU settings because critically ill patients require multiple therapeutic and supportive medications. Similar findings have been reported by Sharma et al. and Patel et al., who documented average drug utilization ranging from 7 to 10 drugs per prescription in intensive care settings.[19,20] Although polypharmacy is often unavoidable in critically ill patients, it increases the risk of drug interactions and adverse drug reactions.

The percentage of drugs prescribed by generic name was 55.9%. WHO recommends prescribing medicines by generic name whenever possible to improve accessibility and reduce treatment costs.[6] The observed value suggests moderate adherence to generic prescribing practices and highlights the need for further promotion of generic prescriptions among healthcare providers.

Antibiotic utilization was extremely high, with all patients receiving at least one antibiotic and antibiotics accounting for 26.14% of total prescribed drugs. This finding is consistent with the high burden of infectious diseases and empirical antimicrobial therapy commonly practiced in ICU settings.[21] Similar studies have reported extensive antibiotic use among critically ill patients.[22,23] While antibiotic therapy is often necessary, judicious use is essential to prevent antimicrobial resistance.

Analysis of drug classes showed that antibiotics were the most frequently prescribed medications, followed by proton pump inhibitors and antiemetics. Similar prescribing patterns have been reported in previous ICU studies where antibiotics, gastroprotective agents, and supportive medications formed the major proportion of prescriptions.[24,25]
A large proportion of medications (72.21%) were administered intravenously, reflecting the critical condition of ICU patients and the need for rapid therapeutic action. Comparable findings have been documented in earlier ICU drug utilization studies.[26]

The percentage of drugs prescribed from the Essential Drug List was 92.3%, indicating good adherence to national and institutional essential medicine policies. High EDL utilization promotes cost-effective prescribing and improves the availability of essential medicines.[27]

Polypharmacy analysis revealed that 69.0% of patients received 5–9 drugs, while 28.8% received ten or more drugs per encounter. Such extensive drug exposure is common in critically ill patients and necessitates regular prescription review to minimize medication-related complications.[28]

The incidence of adverse drug reactions in the present study was 4.42%. Although relatively low, this finding may reflect effective monitoring and reporting practices. Gastrointestinal and dermatological reactions were the most commonly observed ADRs. Similar ADR profiles have been reported in previous ICU studies where gastrointestinal disturbances and skin reactions were among the leading adverse events.[29,30]

Causality assessment using Naranjo's Scale showed that the majority of ADRs were categorized as possible (90%), while only one ADR was classified as probable. These findings are consistent with previous pharmacovigilance studies conducted in hospital settings.[31] Severity assessment using the Modified Hartwig and Siegel Scale demonstrated that most ADRs were mild in nature, with no severe reactions observed. This finding indicates timely recognition and management of ADRs in the ICU setting.[32]

Overall, the present study highlights the prevalence of polypharmacy, extensive antibiotic utilization, and relatively low ADR incidence in critically ill patients. Continuous prescription auditing, antimicrobial stewardship programs, and strengthened pharmacovigilance activities are essential to promote rational drug use and improve patient safety in intensive care units.

CONCLUSION

The present study demonstrated a high prevalence of polypharmacy among Medicine ICU patients, with an average of 8.57 drugs prescribed per encounter. Antibiotics were the most commonly prescribed drugs, and injectable medications were used in all patients. Most drugs were prescribed from the Essential Drug List, although generic prescribing remained suboptimal. The incidence of adverse drug reactions was low (4.42%), with most reactions being mild and categorized as

possible. Regular prescription audits, rational antibiotic use, promotion of generic prescribing, and strengthened pharmacovigilance practices are essential to improve medication safety and rational drug utilization in intensive care settings.

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