Original Article

TRENDS IN PRESCRIPTION PATTERN IN MEDICAL INDIAN ICU AND IT'S IMPACT ON PATIENT OUTCOME

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ABSTRACT

Objective: The objective of this study is to evaluate the trends in prescribing pattern in medical ICU concerning patient age, gender, past, and current illness along with comorbidities for the evasion of polypharmacy and to improve patient outcomes.

Methods: A prospective analysis of the case records of patients admitted to the ICU of Yashoda hospital in India was carried out.

Results: 120 patients were evaluated, consisting of 77% male patients. The mean±SD of age is 53.81±14.63. The majority of the study subjects belonged to the age group of 50-67 y (32%) Most common causes for admission to the ICU were Respiratory diseases and Stroke. Diabetes mellitus and Hypertension are the most common co-morbidities identified. The total number of drugs used were 1502 during this study period. The average number of drugs per prescription is 12. The range is between 2-30. The average number of antibiotics per prescription is 3. Commonly prescribed drug classes were the GI agents in 100% of patients, followed by antimicrobial agents (AMAs) in 95.8% of patients. About 42.5% of patients received 3 antibiotics per day. 55 potential drug-drug interactions were interpreted in 46 patients. 30(55%) were moderate interactions 25(45%) were major interactions, which were addressed. De-escalation of antibiotics was seen in 29% of patients while escalation in 13%. The death rate is only 5% in our ICU setting.

Conclusion: This prescription pattern study can provide a framework for continuous prescription audit in the ICU

Keywords: Prescription pattern, Intensive care unit, Antimicrobial agents

INTRODUCTION

The Intensive Care Unit is a setting where a large number of drugs are administered to most of the patients due to their critical illness and multiple complexities [1]. The medical ICUs represent an important platform for conducting prescription pattern studies as they explain the extent and profile of drug use, trends, and impact on patient outcomes [2].

Prescription pattern study provides insights regarding drug use. Quality of life can be improved by enhancing the standards of medical treatment and that can only be assessed by prescription pattern study because it is based on documented evidence to support diagnosis, treatment, and justified utilization of hospital facilities [3]. There is an increasing importance of prescription pattern study because of boost in marketing of new drugs, variation in the pattern of prescribing and consumption of drugs leading to growing concern to provide the best healthcare [2]. Analyses of prescription patterns will help in the evasion of polypharmacy and improve patient outcomes.

Polypharmacy can lead to Drug-drug interactions, increased drug adverse effects, medication errors, and high cost. Appropriateness of polypharmacy in ICU and its implication on patient outcome is always a debated issue among Healthcare professionals. Multiple anti-microbial and their rational use in ICU is a challenging issue.

The main objective of this study is to evaluate the prescribing patterns concerning patient age, gender, past, and current illness along with co-morbidities. Other objectives of the study were to assess the appropriateness of drugs ordered based on patient diagnosis to determine the number of drugs prescribed, and to compute the average number of medicines per prescription, to ascertain the patient's outcome, and to assess the possible drug interactions found in the prescription.

MATERIALS AND METHODS

Study design and data collection

The case records of 120 patients admitted to the ICU at a tertiary hospital in India were analyzed in this prospective and observational study. Data collection was done using a pre-designed proforma. The variables collected were demographic and clinical characteristics. We also considered the indication and utilization of different drugs.

Inclusion criteria

Patients between the ages of 16 and 90 y old suffering from multiple illness who had been admitted in the ICU and patients who require special assistance are included in this study.

Exclusion criteria

Patients who are under the age of 15 y, pregnant or nursing mothers and patients with a limited stay (<24 h) in the CCU are excluded from the study.

Ethical approval was obtained from the Anurag group of Institutions. This approval provides permission to utilize patients' data in a confidential manner without disclosing patients' details

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Statistical analysis

After the collection of data, it was entered in a Microsoft Excel sheet and verified. A clean data sheet was generated and the analysis was done in SPSS. Descriptive statistics were used to describe the data. The analyses were performed using an Independent t-test, Fishers's exact test, Pearson correlation test whenever appropriate. Confidence interval is 95%, hence P-value<0.05 is considered significant.

RESULTS

We collected the data of 120 prescription forms of the patients who were admitted to ICU. Our study showed the following results when we observed the demographic profile of the patients. The study revealed that male patients were more in number (77%) compared to female patients (23%). The majority of prescriptions (32%) belonged to patients of 58-67 y age group; the mean±SD of age is 53.81±14.63. (table 1 and table 2 explain the aforementioned observations).

The observed disease pattern was variable. Diseases of the respiratory system were maximum 20.70% followed by neurological diseases 19.90%; infectious diseases were 18.20%, diseases of GI were 7.30%, RTA and poisoning were 5.00% each, malignant cases were 3.30%, renal disorders and hematology disorders are 1.60% each. (table 3 explain the above results). Diabetes mellitus (24%)

and systemic hypertension (20%) were the most common underlying co-morbid conditions (table 4 explain about these details).

Table 1: Age distribution

Age interval (years)	N=120	Percentage (%)
18-27	9	7
28-37	7	6
38-47	20	17
48-57	27	22
58-67	38	32
68-77	15	13
78-87	4	3

The mean±SD of age is 53.81±14.63

Table 2: Gender wise distribution

Gender	N (%)	Median	mean±SD	P value
Male	92(77)	55.5	53.98±14.41	
Female	28(23)	55.5	53.25±15.57	0.8187

It indicates that there is no statistically significant difference in the mean age between male and female patients.

Table 3: Diagnostic criteria

Diagnosis	No of patients	Percentage (%)
Respiratory	25	20.70%
COVID	4	3.30%
Pneumonia	6	5.00%
COPD	1	0.80%
RF-II	7	5.80%
LRTI	7	5.80%
Neuro	24	19.90%
Stroke	20	16.60%
Seizures	4	3.30%
Infectious diseases	22	18.20%
Cellulitis	2	1.60%
Sepsis	17	14.10%
TB	3	2.50%
Others	19	15.80%
GI	9	7.30%
Acute ge	4	3.30%
CLD	2	1.60%
Jaundice	1	0.80%
Pyloric obstruction	1	0.80%
GI Bleed	1	0.80%
RTA	6	5.00%
Poisoning	6	5.00%
Malignancy	4	3.30%
Renal disorders	2	1.60%
CKD	2	1.60%
Hematology	2	1.60%
Vascular injury	2	1.60%
CVS	1	0.80%
Cardiogenic shock	1	0.80%

Table 4: Comorbidities exist in the study population

Comorbidity	No. of patients	Percentage
Diabetes mellitus	29	24
Hypertension	24	20
Chronic kidney disease	5	4
Chronic liver disease	1	1
Cancer	3	3
Hypothyroidism	6	5
CAD	9	8
COPD	3	3
Asthma	2	2
Seizures	3	3
Post COVID	10	8

120 patients were included in the study. The total no of drugs is 1502. The average number of drugs per patient is 12, with a maximum number of 30 drugs per patient and a minimum number of drugs per patient was 4. (table 5.1 explains these details).

About 45.8% of patients received prescriptions in the range of 11-15 drugs, 4.2% of patients received no antibiotics, 1 antibiotic was prescribed in 20.80% of patients, 2,3,4 antibiotics were prescribed in 30.8%, 42.6%, 1.6% patients, respectively. (table 5.2, table 5.3 and fig. 1 explain these details).

Polypharmacy

Table 5.1: Details of prescription

Details of prescription	Number
Total no of drugs	1502
Maximum no of drugs/prescription	30
Average no of drugs/prescription	12
Minimum no of drugs/prescription	4

Table 5.2: No of drugs/prescription

No of drugs/prescription	Male	Female	Total	Percentage (%)
0-5	3	3	6	5
6-10	25	17	32	26.6
11-15	44	11	55	45.8
16-20	17	6	23	19.4
21-25	2	0	2	1.6
26-30	2	0	2	1.6

Table 5.3: No of antibiotics/day

No of antibiotics/day	No of patients	Percentage (%)
0	5	4.2%
1	25	20.8%
2	37	30.8%
3	51	42.6%
4	2	1.6%

The most common drug groups prescribed were GI drugs given in 120 patients, Multi-vitamins 117, Antibiotics 115, Others 114, CVS 75, anti-platelets and anti-coagulants 69, sedatives 69, Anti-epileptics 51, Respiratory drugs 33, anti-pyretics 31. GI and DVT prophylaxis was given in 100% and 47.5% of patients respectively, (table 6 and table 7 and fig. 2 explain these details).
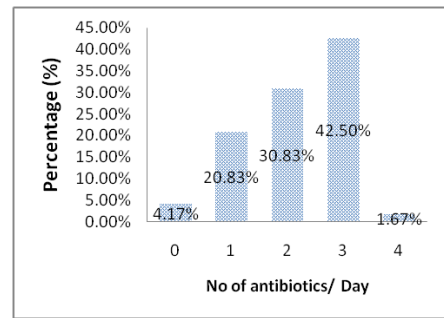

Fig. 1: No of antibiotics/Prescription/Day

Table 6: Categories of drugs

Category	Maximum	Average	Total	No of patients
GI	6	1	168	120
Multi-vitamins	3	2	285	117
Antibiotics	4	3	326	115
Others	2	1	218	114
CVS	7	2	172	75
Anti-platelets and anti-coagulants	4	1	99	69
Sedatives	3	1	73	69
Anti-epileptics	3	1	64	51
Respiratory drugs	3	2	59	33
Analgesics and Anti-pyretics	2	1	38	31

Table 7: Prophylactic indication

	No. of patients	Percentage (%)
GI prophylaxis	120	100%
DVT prophylaxis	57	47.5%

The prescriptions were also studied for possible drug-drug interactions. We found a total of 55 potential drug-drug interactions, 25(45%) were major and 35(55%) were moderate Drug-Drug interactions. Details of the possible Major Drug-Drug interactions are shown in the following fig. 3. There was at least one potential drug-drug interactions per prescription in 69% of patients, 2 and 3 were seen in 25.6% and 5.4 % of patients, respectively (table 8) shows the details.
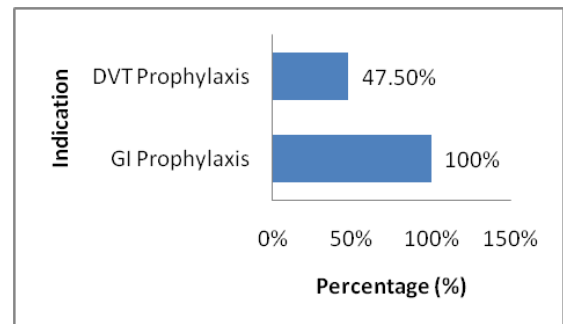

Fig. 2: Prophylactic indication

Table 8: No of interactions/prescription

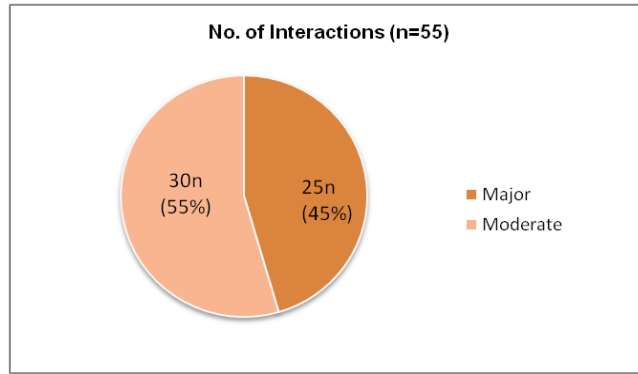| No of interactions/prescription	Total no of patients	Percentage (%)	SAE/AE
1	38	69	NIL
2	7	25.6	NIL
3	1	5.4	NIL

Fig. 3: Severity of interaction

It was found that the most commonly administered antibiotic in ICU in our setting is cefaperazone+salbactum 18.71%, followed by meropenem 14.11%, Teicoplanin 7.36%, Clindamycin 7.36%, Metronidazole 6.13%, Polymixin B 4.60%, Ceftriaxone-3.99%, Fluconazole and Doxycycline 3.68% each, Cefuroxime 2.76%, Piperacillin+tazobactum 2.76%, Colistin 2.15%, Sulphamethazole+Trimethoprim and Voriconazole 2.15% each, Minocycline and Vancomycin 1.84% each, Linezolid 1.53%, (table 9 shows the details).

Table 9: Antibiotics prescribed In ICU

Antibiotic	No. of patients	Percentage (%)
Cefaperazone+salbactum	61	18.71%
Meropenem	46	14.11%
Teicoplanin	24	7.36%
Clindamycin	23	7.06%
Metronidazole	20	6.13%
Polymixin B	15	4.60%
Ceftriaxone	13	3.99%
Fluconazole	12	3.68%
Doxycycline	12	3.68%
Cefuroxime	9	2.76%
Piperacillin+tazobactum	9	2.76%
Colistin	7	2.15%
Sulphamethazole+Trimethoprim	7	2.15%
Voriconazole	7	2.15%
Minocycline	6	1.84%
Vancomycin	6	1.84%
Linezolid	5	1.53%
Clarithromycin	4	1.23%
Ceftazidine	3	0.92%
Tigecycline	3	0.92%
Amoxicillin	3	0.92%
Amikacin	2	0.61%
Ampicillin	2	0.61%
Azithromycin	2	0.61%
Cefipime+Tazobactum	2	0.61%
Fosfomycin	2	0.61%
Imipenem	2	0.61%
Levofloxacin	2	0.61%
Amoxicillin+clavulanic acid	2	0.61%
Cefipime	2	0.61%
Cefixime	2	0.61%
Cefotaxime	2	0.61%
Gentamicin	2	0.61%
Imipenem+cilastatin	2	0.61%
Amidlafugin	1	0.31%
Aztreonam	1	0.31%
Cefotaxime+salbactum	1	0.31%
Ceftraixone+salbactum	1	0.31%
Isavuconazole	1	0.31%
Ivermectin	1	0.31%

Table 10: Indication of antimicrobial Use

Indication	No. of patients	Percentage (%)
Prophylactic	47	39
Empirical	11	9
Confirmatory	62	52

In our analysis, the most prevalent indication for antibiotic usage is confirmatory (52 %) - it is deemed an indication if clinical and/or laboratory results show proof of infection. Following that, prophylactic (39 %) and empirical usage (9 %), (table 10) show the details.

There was no escalation or de-escalation for 58 percent of patients. Overall, antibiotics were escalated in 13% of cases while de-escalated in 29% of cases. It is shown in fig. 4.
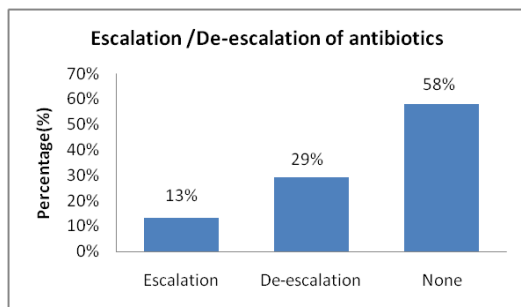

Fig. 4: Escalation/De-escalation of antibiotics

In terms of patient outcomes, during their stay in the ICU, 67% were transferred to general wards, 5 percent died, and 28 percent were discharged directly from the ICU (table 11).

Table 11: Outcomes of treatment

Outcome	No. of patients	Percentage (%)
Discharged	34	28
Shifted to ward	80	67
Death	6	5

DISCUSSION

In the present study, we studied 120 patients' prescriptions admitted to ICU. 32 % of patients were mostly grouped within the age of 58-67 y as shown in table 1. The mean±SD of age is 53.81±14.63; among 120 patients, 92(77%) were male and 28(23%) were female. This difference could be due to geographic variation in disease occurrence. In a study done by Al-zakwani *et al.*, they found that among 138 patients admitted to the ICU during the 5-month study period revealed that the mean age of the patients was 46±19 y, with males representing 64% of the patients [5]. This finding was similar to the two studies conducted in eastern and southern India in 2007 and 2011 [1].

The most common illnesses, accounted for ICU admission in the study were respiratory disorders followed by neurological disorders, which is similar to a study in Nepal where the most common causes were chronic obstructive pulmonary disease, cerebrovascular accident, and myocardial infarction [9].

Diabetes mellitus (24%) and systemic hypertension (20%) were the most common underlying co-morbid conditions and this adds to the existing body of evidence that these diseases are assuming epidemic proportions in developing countries. It is similar to a study conducted by Rajathilagam *et al.* in a medical ICU of a tertiary care teaching hospital of south India [11].

120 patients were included in the study. The total no of drugs is 1502. The average number of drugs per patient was 12.0 with a maximum number of 30 drugs and a minimum number of drugs 4. This is comparable to other previous studies. In an American study conducted in a trauma ICU, the average number of prescribed drugs was 9.1 while an Indian study showed an average of 13.5 drugs [6].

The average number of drugs per person is an important index of trends in a prescription pattern. It is preferable to keep the mean number of drugs per prescription as low as possible since high fig. always lead to increased risk of drug interactions, polymicrobial use may cause the development of bacterial resistance, and increased hospital cost.

It is noted that a total number of antibiotics prescribed were 326 in 120 prescriptions; the maximum number of antibiotics prescribed per prescription was 4 at a time. The average number of antibiotics per prescription was 3 during the hospital stay.

About 95.8% of the patients received antibiotics, and the average number of AMAs per patient was 3. About 20.83% of patients received one AMA; another 30.83% received two AMAs, 42.50% were administered three AMAs and 1.67%were given four AMAs. This is similar to a study where 77% of the ICU patients were given 1-3 AMAs, 23% were given 4-8 AMAs [8]. In our study, patients received more than one AMA as some of the patients were suffering from mixed infections; three or more AMAs are used to treat Gram-positive, Gram-negative, and anaerobic infections. In many instances, antibiotic change is as per the culture sensitivity tests.

Polypharmacy was visible in our data. The maximum number of prescriptions i.e. 45.8% had 11-15 drugs, followed by 6-10 in 26.6% and 16-20 drugs in 19.4%. Polypharmacy is a very common practice nowadays as it is reported by various studies. It is of concern in those patients with various co-morbidities as it increases the chances of drug interactions. Though it is polypharmacy, there is a need for empirical therapy until definitive diagnosis becomes clear and multiple drug usage is essential for the management of acute life-threatening conditions. In addition, patients who are admitted to the ICU may have more than one disease, and treating all of them effectively with multiple drugs can lead to better outcomes.

The total number of GI drugs includes 168, of which pantoprazole (100%) is most commonly prescribed drug. A study in Western Nepal found that pantoprazole was the most frequently prescribed [7]. The total no of CVS drugs includes 172 out of which Atorvastatin and Metoprolol are the most common drugs prescribed, on average, the CVS drugs per prescription was 2. Under the anti-platelets and anti-coagulants drugs, the most common drug is enoxaparin, which was given for about 47.5 % of patients i.e. indicated for DVT prophylaxis. The most common respiratory drug prescribed is salbutamol as nebulization. On average 2 drugs per prescription were prescribed. Levetiracetam is the most common Anti-epileptic prescribed. The maximum number of multi-vitamins per prescription includes 3 and on average 2 were prescribed; the most common drug is Optineuron.

While analyzing the prescriptions for possible drug-drug interactions, 55 drug-drug interactions were interpreted in 46 patients. Most of them were moderate 30 (55%) followed by major interactions 25 (45%). Drug interactions can be potentially hazardous but most of the consequences of interactions can be overcome with careful monitoring of the patient. When evaluating DIs, one primary concern was the clinical significance or level of severity of the interaction. Even though a large number of potential DIs were identified in this study, they were no clinically significant events and only required the monitoring of patients. Various interventions can be made for DIs, such as substituting the drug, stopping or avoiding or adjusting the dose, and monitoring of DI effects. Most of the interventions were to monitor patient parameters such as renal function, liver function, electrolyte levels, monitoring for CNS and respiratory depression; however, such things were routinely carried out in the ICU even before the commencement of this study.

It was reported in our study that there was one interaction per prescription accounting for 38 patients (69%) whereas, two interactions per prescription and three interactions per prescription were seen in for 7(25.6 %) and 1(5.4 %).

The most common AMA's prescribed was cefoperazone+sulbactum 18.71%; Meropenem 14.11% Teicoplanin 7.36% Clindamycin 7.06% Metronidazole 6.13%. This is similar to an ICU study in Maharashtra, which reported the use of cephalosporins and aminoglycosides in 65.33% and 27.5% of the individuals on AMA therapy but differed from another study in which the penicillins were the most common

antimicrobial drug class prescribed [9]. Cephalosporins are commonly prescribed due to their relatively lower toxicity and broader-spectrum activity.

In our analysis, the most prevalent indication of AMA therapy was confirmatory (52%), which is deemed an indication of clinical or laboratory results showing evidence of infection. Following which were prophylactic (39%) and empirical (9%) indications.

Overall, escalation is seen in 13% of cases where de-escalation occurred in 29% of cases. When a significant pathogen was isolated, escalation occurred more frequently, in contrast to most individuals with no pathogen had no change in therapy.

The outcomes of the patients during their stay in ICU is about 67% of patients were shifted to a ward while 5 % were deceased.

LIMITATIONS

Our study has limitations, as it was a prospective observational study; the sample size is relatively small in the mixed ICU, which may not fully reflect the accurate population characteristics and the assessment of medication errors was not assessed.

CONCLUSION

In our study, we studied the Prescription pattern in a tertiary care medical ICU managing critical illness. The average number of drugs is 12 per prescription, indicating polypharmacy, as the patients in ICU are critically ill with multiple complexities. It was seen that a variety of drugs from various drug classes were used for a wide spectrum of clinical diagnoses. Respiratory disorders were the most common cause of ICU admission. Hypertensive and Diabetes mellitus are the most common co-morbidities observed. GI drugs and Antimicrobials are commonly used drugs in ICU. PPI(Pantoprazole is prescribed in all the patients as GI prophylactic therapy). In addition, to avoid antibiotic resistance, de-escalation is done where necessary. Even after the 55 potential drug interactions i.e., moderate 35(55%) and major 25(45%) were analyzed and addressed there is no clinical significant event observed. The 95% of patients either has been discharged or shifted to other wards and death is seen in 5% of the study population. This prescription pattern study can provide a framework for continuous prescription audits in the ICU for improving patient oucomes.

ABBREVIATIONS

ICU–Intensive Care Unit, AMA–Anti-microbial agents, CVS–Cardiovascular System, CNS–Central nervous system, GI–Gastrointestinal, DVT–Deep vein thrombosis, NSAID–Non-steroidal anti-inflammatory drugs, DI–Drug Interaction

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AUTHORS CONTRIBUTIONS

Dr. Venkat Raman Kola designed the study and drafted the manuscript; Meda Hemasree and Sharon Rose raised the idea, participated in the study conception and manuscript revision, collected the data from the hospital and was also involved in statistical analysis, Kishore collected the data from the hospital and also involved in statistical analysis.

CONFLICT OF INTERESTS

Declared none

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