International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

Antibiotic Prescription Patterns Study in Surgical Intensive Care Unit

Deepak Kumar Verma[1], Anusuya Gehlot[2], Rajkumar Rathore[3], Manish Jha[4], Manish Singh Chauhan[5], Narendra Parmar[6]

[1]PhD- Scholar, Department of Pharmacology, Dr. SN Medical College, Jodhpur.
[2,3]Senior Professor, Department of Pharmacology, Dr. SN Medical College, Jodhpur.
[4,5]Assistant Professor, Department of Anaesthesia, Dr. SN Medical College, Jodhpur.
[6]PG Resident, Department of Pharmacology, Dr. SN Medical College, Jodhpur.

Abstract:
Introduction: This study aimed to assess Antibiotic prescription patterns study in surgical intensive care unit.
Materials and methods: This was a prospective, observational study of antibiotic prescribing patterns at admission into the surgical ICU. The prescription data on 100 consecutive patients at admission into the surgical ICU was audited. Patients of all age of either gender admitted in the surgical ICU during the study period, who have been prescribed with antibiotics. The study was conducted over a period of eight months from August 2022 march 2023. During this period, all the included patients were followed up for their entire duration of stay in surgical ICU.
Results: The prescriptions of 100 consecutive patients admitted into the ICU were analyzed. This included 68 male and 32 female patients. Most of the patients admitted in SICU were of the age groups 20-40 years. Most of the patients admitted in surgical ICU of 35-65 age group and two/three antibiotics prescription was statistically significant ($P<0.05$) in compare to one/ more than three antibiotic prescription in that age group. Those patients were stayed < 6 days or > 10 days mostly prescribed two or three antibiotics. The mortality rate was 31% in surgical intensive care unit. 69% patients were transferred to different wards of the hospital. The mortality rate was high before 7 days (67.7%) as compared to after 07 days (32.25%). The average duration of stay in surgical ICU was 7.18 days and average number of drugs prescribed was 6.2. The average duration of antimicrobials including all prescribed antibiotics to 100 surgical ICU patients was 6.97. There were 16(16%) single antibiotic prescriptions, 36 (36%) prescription contained 2 antibiotics, 45 (45%) prescriptions contained 3 antibiotics and 03 prescriptions contained more than 3 (3 %) antibiotics. Highest prescribed antibiotic group was cephalosporin (25.10%) followed by carbapenems (20.85%) in surgical intensive care unit.
Conclusion: In conclusion, our study reveals that antibiotics continue to be widely prescribed in critically ill patients of surgical intensive care unit.

Keywords: Antibiotics, Surgical Intensive Care Unit, Prescription Pattern.

Introduction:

Problems associated with drug prescription are quite common worldwide. Errors in the drug prescription

are considered as a key threatening factor that affects patient safety throughout hospital practice.[1] Patients admitted into the intensive care units (ICUs) are often prescribed multiple broad spectrum antibiotics at admission as they are more sick, exposed to multiple invasive procedures, and vulnerable to multidrug-resistant pathogens. This not only increases the burden of antibiotic resistance but also exposes patients to the unnecessary side effects of these drugs besides increasing treatment costs. However, these prescriptions are often empiric and based on physician comfort and prior experience, often leading to overuse or misuse of antibiotics. This not only increases the burden of antibiotic resistance but also exposes patients to the unnecessary side effects of these drugs besides increasing treatment costs.[2, 3] Despite the existence of various guidelines regarding drug usage in ICUs, sometimes their implementation might be challenging owing to factors such as patient-specific illnesses, resident learning curves, and physician drug preferences.[4] There is limited data from Indian ICUs on antibiotic prescription and consumption patterns especially on surgical intensive care unit.

So the aim of this study was to access Antibiotic prescription patterns study in surgical intensive care unit.

Materials and Methods

This was a prospective, observational study of antibiotic prescribing patterns at admission into the surgical ICU. This study was conducted in the department of Pharmacology at Dr. S.N. Medical College & Hospital, Jodhpur. The prescription data on 100 consecutive patients at admission into the surgical ICU was audited. Patients of all age of either gender getting admitted in the surgical ICU during the study period, who have been prescribed with antibiotics and were willing to participate, were included in the study. Patients in which the antibiotics were not prescribed and those were not fulfilling the criteria as WHO defined for drug utilization study were excluded. The study was conducted over a period of eight months from August 2022 march 2023. During this period, all the included patients were followed up for their entire duration of stay in surgical ICU.

Baseline demographic variables on all patients, such as name, age, gender, hospital number, clinical diagnosis were recorded. Other variables, such as duration of ICU admission, the total number of drugs prescribed on the day of admission, diseased in which admitted, mortality, duration of ICU stay and the total number of antibiotics prescribed were noted.

Standard data entry format was designed as per WHO guidelines and used to enter all the patient details collected during rounds. The prescriptions were individually screened to assess the prescribing pattern of antibiotics. Various drug utilization metrics were analyzed in accordance with the World Health Organization Anatomical Therapeutic and Chemical Classification/ Defined Daily Dose (WHO ATC/DDD) methodology.[5]

Statistical analysis

Data was expressed as Mean ± SD. All the data were entered into a master chart using a Microsoft Excel sheet and subjected to statistical analysis. All the analyses were carried out using SPSS software. A P-value < 0.05 was considered statistically significant.

Results:

The prescriptions of 100 consecutive patients admitted into the ICU were analyzed. This included 68 male and 32 female patients. Most of the patients admitted in SICU were of the age groups 20-40 years (Table 1).

Table 1: Demographic data and patient characteristics.

		Number	Percentage
Gender	Male	68	68%
	Female	32	32%
Age Distribution (Years)	Mean ± SD	47.21±17	
	< 20	13	13%
	20 – 40	38	38%
	41- 60	24	24%
	61-80	25	25%

Age wise distribution of the patients were analyzed and it was found that 38% of the prescriptions were in the age group belongs to 20-40, followed by 25% in the age group of 61-80 years, 24% in the age group of 41-60 years, and 13% in the age group of < 20 years.

Table 2: Demographical distribution of patients according to the number of antibiotics prescribed.

			No. of Antibiotics				p value
		N	1 Antibiotics	2 Antibiotics	3 Antibiotics	> 3 Antibiotics	
Gender	Male	68	8	27*	31*	2	P<0.05
	Female	32	8	9	14*	1	
Age	< 35	26	2	10*	14*	**0**	P<0.05
	35-65	57	10	22*	22*	3	
	> 66	17	4	4	9	0	
Duration of stay	< 6 days	58	7	21*	27*	**3**	P<0.05
	6 -10 days	26	6	11	9	0	
	> 10 days	16	3	4	9*	0	

P<0.05 (Z test) is considered significant.

In the study number of antibiotics prescribed was compared with gender, age and duration of treatment and it was found that most of male patients were prescribed with three and two antibiotics in each prescription and its statistically significant (P<0.05) in compare to one and more than three antibiotic prescription. Most of female patients were prescribed three antibiotic and it's statistically significant (P<0.05) in compare to one, two and more than three antibiotic prescription. Most of the patients admitted in surgical ICU were belongs to 35-65 age group and two/three antibiotics prescription was statistically significant (P<0.05) in compare to one/ more than three antibiotic prescription in that age group. Those patients were stayed < 6 days or > 10 days mostly prescribed two or three antibiotics (**Table 2**).

Table 3: Patients characteristics and drugs prescription.

	(n=100)
Mortality (Total)	31
Mortality before 07 days	21
Mortality after 07 days	10

Transfer to ward	69
Average Duration of stay in ICU	7.18
Average number of drugs prescribed	6.2
Average duration of antimicrobial agents	6.97

The mortality rate was 31% in surgical intensive care unit. 69% patients were transferred to different wards of the hospital. The mortality rate was high before 7 days (67.7%) as compared to after 07 days (32.25%). The average duration of stay in surgical ICU was 7.18 days and average number of drugs prescribed was 6.2. The average duration of antimicrobials including all prescribed antibiotics to 100 surgical ICU patients was 6.97.

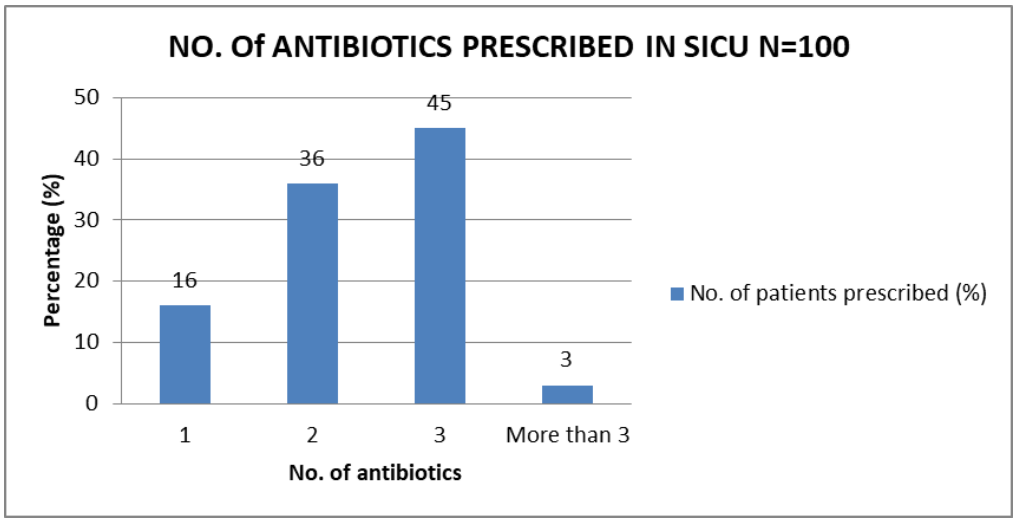

Figure 1: Distribution of patients according to the number of antibiotics prescribed.

There were 16(16%) single antibiotic prescriptions, 36 (36%) prescription contained 2 antibiotics, 45 (45%) prescriptions contained 3 antibiotics and 03 prescriptions contained more than 3 (3 %) antibiotics.

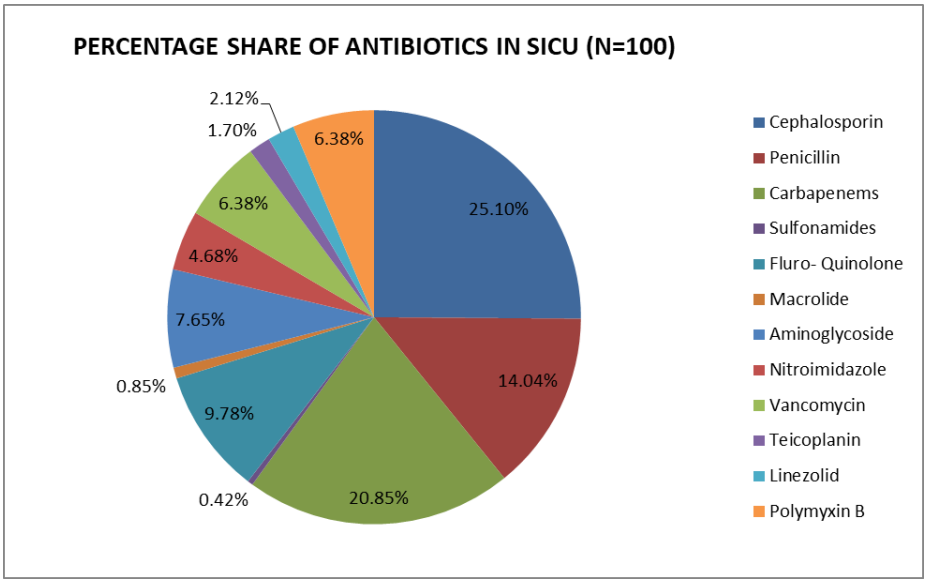

Figure 2: Percentage share of antibiotics in surgical intensive care unit.

Highest prescribed antibiotic group was cephalosporin (25.10%) followed by carbapenems (20.85%) in surgical intensive care unit. The maximum percentage of individual antibiotic meropenem (18.29%) was prescribed followed by piperacillin+tazobactam (9.78%). Among cephalosporin maximum percentage of cefoperazone+sulbactam was prescribed (7.13%) followed by ceftriaxone (6.38%) (**Figure 2**).

Discussion: Prescriptions of 100 consecutive ICU admissions were audited over a 3-month period to study drug utilization patterns in the ICU. This included 68 male and 32 female patients. Most of the patients admitted in SICU were of the age groups 20-40 years (38%). The mean age was 47.1 years. In a study on drug use patterns from an ICU in Iran, the average age of patients studied was 50 years.[6] Priyadharsini et al. found that most of the patients were in the age group 40-60 years and 57% of the population were males.[7]

In this study number of antibiotics prescribed was compared with gender, age and duration of treatment and it was found that most of male patients were prescribed with three and two antibiotics in each prescription and its statistically significant (P<0.05) in compare to one and more than three antibiotic prescription. Most of female patients were prescribed three antibiotic and it's statistically significant (P<0.05) in compare to one, two and more than three antibiotic prescription. Most of the patients admitted in surgical ICU were belongs to 35-65 age group and two/three antibiotics prescription was statistically significant (P<0.05) in compare to one/ more than three antibiotic prescription in that age group. Those patients were stayed < 6 days or > 10 days mostly prescribed two or three antibiotics. But contrarily a study conducted by Pandiamunian et al. in Puducherry where only 17% patients were given a more than 2 antimicrobials.[8] Prescribing more than two antimicrobials may be due to critical illness and longer duration of stay. The mean length of stay of all patients admitted to the ICU was 4.5 days in the study of Al-zakwani et al.[9]

The mortality rate was 31% in surgical intensive care unit. 69% patients were transferred to different wards of the hospital. The mortality rate was high before 7 days (67.7%) as compared to after 07 days (32.25%). Contrarily, Blot et al. reported 61% mortality rate during study period in intensive care unit.[9] The average duration of stay in surgical ICU was 7.18 days and average number of drugs prescribed was 6.2. The average duration of antimicrobials including all prescribed antibiotics to 100 surgical ICU patients was 6.97. The mean length of stay of all patients admitted to the ICU was 4.5 days in the study of Al-zakwani et al.[10] But almost Similarly, in a study by Bergmans *et al*. the average duration of patient stay in the ICU was 7 days.[11] But study done by Smythe et al. where mean number of drugs prescribed were 12.6.[12]

There were 16% single antibiotic prescriptions, 36% prescription contained 2 antibiotics, 45 45% prescriptions contained 3 antibiotics and 03 prescriptions contained more than 3% antibiotics. Hariharan *et al* reported that 60% of the patients studied in a Caribbean ICU received two antimicrobials.[13] A study in a Danish university hospital ICU reported that the majority of their patients were on one antibiotic, whereas in a German surgical ICU, 36.7% of cases were treated with only one antibiotic agent, 14.1% were given a combination of 2, and 7.2% were given a combination of ≥3 antibiotic agents.[14, 15]

Highest prescribed antibiotic group was cephalosporin (25.10%) followed by carbapenems (20.85%) in surgical intensive care unit. The maximum percentage of individual antibiotic meropenem (18.29%) was prescribed followed by piperacillin+tazobactam (9.78%). Among cephalosporin maximum percentage of cefoperazone+sulbactam was prescribed (7.13%) followed by ceftriaxone (6.38%). Similarly, Williams et al. also reported that most frequently prescribed antibiotics were 3rd generation

cephalosporins followed by metronidazole.[16] Biswal *et al* reported that the most frequently prescribed antibiotic at ICU admission was metronidazole followed by cefotaxime, amoxycillin/clavulinic acid, cefipime, and ciprofloxacin.[17] In another Indian study, the most commonly prescribed antibiotics at admission were cefaperazone/sulbactum or piperacillin/tazobactam.[18]

Conclusion

In conclusion, our study reveals that antibiotics continue to be widely prescribed in critically ill patients of surgical intensive care unit. Prescribing guideline is required to reduce the prevalent poly-pharmacy and to promote appropriate use of antimicrobial drugs.

References:

1. U.S. Food and Drug Administration (FDA). (2014). Preventable Adverse Drug Reactions: A Focus on Drug Interactions. Retrieved August 6; 2015. Available from: http://www.fda.gov/Drugs/DevelopmentApprovalProcess/DevelopmentResources/DrugInteracionsLabeling/ ucm110632.htm. [Last accessed on 2024 September 17].
2. Weber RJ, Kane SL, Oriolo VA, Saul M, Skledar SJ, Dasta JF. Impact of intensive care drug costs: A descriptive analysis, with recommendations for optimizing ICU pharmacotherapy. Crit Care Med. 2003;31:17–24.
3. Paterson DL, Rogers BA. How Soon Is Now? The urgent need for randomized, controlled trials evaluating treatment of multidrug-resistant bacterial infection. Clin Infect Dis. 2010;51:1245–7.
4. Bobek, Mary Beth, et al. "Utilization patterns, relative costs, and length of stay following adoption of MICU sedation guidelines." *Formulary* 36.9 (2001): 664-664.
5. Badar VA, Navale SB. Study of prescribing pattern of antimicrobial agents in medicine intensive care unit of a teaching hospital in Central India. J Assoc Physicians India. 2012 Apr;60:20-3.
6. Tavallaee M, Fahimi F, Kiani S. Drug-use patterns in an intensive care unit of a hospital in Iran: An observational prospective study. Int J Pharm Pract. 2010;18:370–6.
7. Priyadharsini RP, Ramasamy K, Amarendar S. Antibiotic-prescribing pattern in the outpatient departments using the WHO prescribing indicators and AWaRe assessment tool in a tertiary-care hospital in South India. J Family Med Prim Care. 2022 Jan;11(1):74-78.
8. Pandiamunian J, Somasundaram G. A study on prescribing pattern of anti microbial agents in the medical intensive care unit of a tertiary care teaching hospital in Puducherry union territory, South India. Int J Pharm Pharm. 2014; 6(3): 235-8.
9. Blot S, Vandewoude K, Bacquer D, Colardyn F. Nosocomial Bacteremia Caused by Antibiotic-Resistant Gram-Negative Bacteria in Critically Ill Patients: Clinical Outcome and Length of Hospitalization. Clin Infect Dis. 2002; 34(12): 1600–6.
10. Al-Zakwani I, Al-Thuhli M, Al-Hashim A, Al Balushi KA. Drug utilization pattern in an intensive care unit at a tertiary care teaching hospital in Oman. Asian J Pharm Clin Res 2017;10:194-7.
11. Bergmans DCJJ, Bontena MJM, Gaillard CA, van Tiel FH, van der Geesta S, de Leeuwa PW, et al. Indications for antibiotic use in ICU patients: A one-year prospective surveillance. J Antimicrob Chemother. 1997;39:527–35.
12. Biswal S, Mishra P, Malhotra S, et al. Drug utilization pattern in the intensive care unit of a tertiary care hospital. J Clin Pharmacol. 2006; 46(8): 945-51.
13. Hariharan S, Pillai G, McIntosh D, Bhanji Z, Culmer L, Harper-McIntosh K. Prescribing patterns

and utilization of antimicrobial drugs in a tertiary care teaching hospital of a Caribbean developing country. Fundam Clin Pharmacol. 2009;23:609–15.

14. Hartmann B, Junger A, Brammen D, Röhrig R, Klasen J, Quinzio L, et al. Review of antibiotic drug use in a surgical ICU: management with a patient data management system for additional outcome analysis in patients staying more than 24 hours. Clin Ther. 2004;26:915–24.
15. Meyer E, Jonas D, Schwab F, Rueden H, Gastmeier P, Daschner FD. Design of a surveillance system of antibiotic use and bacterial resistance in German intensive care units (SARI) Infection. 2003;31:208–15.
16. Williams A, Mathai AS, Phillips AS. Antibiotic prescription patterns at admission into a tertiary level intensive care unit in Northern India. J Pharm Bioallied Sci. 2011 Oct;3(4):531-6.
17. Biswal S, Mishra P, Malhotra S, Puri GD, Pandhi P. Drug Utilization Pattern in the Intensive Care Unit of a Tertiary Care Hospital. J Clin Pharmacol. 2006;46:945–51.
18. Shrikala B, Kranthi K, Nafisa A prospective study on evaluation of antibiotic prescription practices in an intensive care unit of a tertiary care hospital. J Clin Diag Res. 2010;4:3387–91.