

Prescription Patterns of Antibiotics in Acute Medical Care Units of a Tertiary Care Hospital in India

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Abstract: Patients admitted into the acute medical care units (AMC) in tertiary hospitals suffer severe diseases, exposed to multiple antibiotics before admission that keeps them vulnerable to multidrug-resistant pathogens. This study attempts to determine the group of antibiotics are prescribed for various conditions, average number and the cost of antibiotics per prescription. The patients admitted in acute medical care unit were explored for, the primary disease and the antibiotics classes were recorded. The cost of antibiotics in prescriptions was calculated from the pharmacy bills of the patients. We found a total of 177 antibiotics were prescribed for the studied 110 patients, with an average of 1.60 (\pm SD 0.77) antibiotics/prescription. The average cost of the antibiotics was INR 269.41 \pm 444.32 per prescription per pat cephalosporins were most commonly prescribed antibiotics. So we could conclude that the empirical treatment with antibiotics is common in acute care units. The antibiotics should be rationally prescribed to prevent emergence of resistance and to minimize the cost burden on the patient.

Key words: Prescription Pattern • Antibiotics • Acute Medical Care Units

INTRODUCTION

Patients admitted into the intensive care units (ICUs) are often prescribed multiple broad spectrum antibiotics at admission. These prescriptions are often empiric and based on physician comfort and prior experience, that lead to overuse or misuse of antibiotics. This not only increases the burden of antibiotic resistance but also exposes patients to unnecessary side effects of these drugs besides increasing treatment costs [1].

Empirical antibiotic therapy is based on therapeutic guidelines and variations exist to reflect local clinical practice. Limiting the duration of antibiotic therapy when clinically appropriate to minimise is important to prevent the emergence or selection of multi-drug resistant organisms (MDRO's) and *Clostridium difficile* infection. Initially for empirical therapy broad spectrum antimicrobials are used that provide coverage against *Streptococcus pneumoniae*, *Legionella* species and aerobic Gram negatives, which later could be changed

depending on response and sensitivity report. The knowledge of likely prevalent strains along with their antimicrobial resistance pattern will help in selection of a particular antimicrobial agent and framing the antibiotic policy for the hospital.

Prompt, appropriate, targeted antimicrobial therapy is life-saving. Patients in ICU often receive antimicrobial therapy that is poorly chosen or is given for too many days. Prescribed treatment is often empirical and early decisions to shift to directed therapy or cessation of therapy can reduce antibiotic exposure significantly. Reduction in antimicrobial exposure leads to reductions in resistance and less cost. Controlling resi within the ICU has potential spill-over effects for the general hospital, Antibiotic Expert Group [2]. There is a dramatic increase in the prevalence of superbugs and there is an equal drop in the number of new antibiotics available. Although the antibiotic potential of herbal plants is widely explored [3, 4, 5], the pipeline of antibiotic research and development is nearly dry, especially when it comes to

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antibiotics active against Gram-negative bacteria. Indian hospitals have reported very high Gram-negative resistance rates, with very high prevalence of ESBL (Extended Spectrum Beta Lactamases) producers and also high carbapenem resistance rates. Increasing carbapenem resistance will invariably result in increased usage of colistin, currently the last line of defence, with a potential for colistin-resistant and Pan Drug Resistant bacterial infections.

The treatment of common diseases like diarrhoea is also becoming difficult as the majority of antibiotics used to treat diarrhoea has developed resistance. The use of antibiotics can be avoided when the diarrhoea can be treated by oral rehydration therapy and with the use of probiotics as antibacterial agents is well documented [6]. There is currently no functioning national antibiotic policy or a national policy to contain antimicrobial resistance in India [7]. The data on antibiotic prescription in tertiary care hospitals particularly in southern India is lacking, thus we propose to study the prescribing pattern of antibiotics in our hospital through average number of antibiotics per prescription with the cost of antibiotics per prescription and the prescription of antibiotics for the diseases affecting various systems.

MATERIALS AND METHODS

This was a prospective, observational study of antibiotic prescribing patterns at admission in an open, mixed medical–surgical, adult, ICU in a tertiary care hospital in southern India. This study was conducted between August and November 2013. The prescription data on 110 consecutive patients at admission into the ICU was audited. All antibiotic prescriptions, with the class of antibiotic and the suspected primary disease location on the first admission day were noted. There was no infectious diseases specialist or antibiotic prescription policy in place at our hospital during the study period. Baseline demographic variables on all patients, such as name, age, gender, hospital number, clinical diagnosis were recorded. Other variables, such as the total number of antibiotics prescribed and their dose and route of administration were also noted. The daily antibiotic cost per patient was calculated by the multiplication of the cost per unit and the number of doses that were used in each patient. The unit price of each antibiotic used was obtained from the hospital pharmacy.

The data were analyzed using graphPad prism software (Version 6.0).

RESULTS

The prescriptions of 110 consecutive patients admitted into the ICU were analyzed. This included 70 male and 40 female patients. The average age of the patients was 44 years (\pm 18.2). Most of our patients were admitted to the ICU from the medical specialty (77.2%) and the demographic data and patient characteristics studied are as given in Table 1.

Table 1: Demographic data of patients

Variable	Number (n=110)	Percentage %
Gender		
Male	70	63.63
Females	40	36.36
Age distribution (years)		
15-30	35	31.81
31-45	24	21.81
46-60	28	25.45
61-75	19	17.27
>76	4	3.63
Department of origin		
Medical	85	77.27
Surgical and trauma	15	13.63
Antibiotics prescribed		
0	3	2.72
1	52	47.27
2	42	38.18
3	10	9
4	3	2.72

Table 2: Average number of antibiotics prescribed and the median cost of antibiotics prescribed to treat various disorders and diseases affecting major organs of the body

System	Average number of antibiotics	Median cost of antibiotics in INR
MODS/sepsis	1.85	2313.25
CNS	1.4	190.8
Fever	1.47	152.65
GIT	1.82	271.04
Blood	1.37	1496.12
Lungs	1.61	429.95
Kidneys	1.44	158.75
Trauma and surgical	1.66	153.46
Others	1.77	524.44

Table 3: Comparison of antibiotic cost with respect to age and diagnosis.

Variable	Cost of antibiotics	
Total	269.41±444.32 (Median cost of INR 125)	
Age		
<45 years (n=51)	171.47±167.40	P<0.01
>45 years (n=59)	384.98±613.83	
Diagnosis		
Medical	179.89±135.61	P>0.05
Surgical	290.52±480.80	

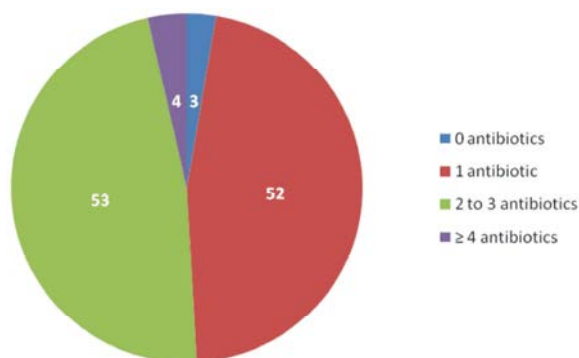


Fig. 1: Shows the distribution of patients according to the number of antibiotics prescribed

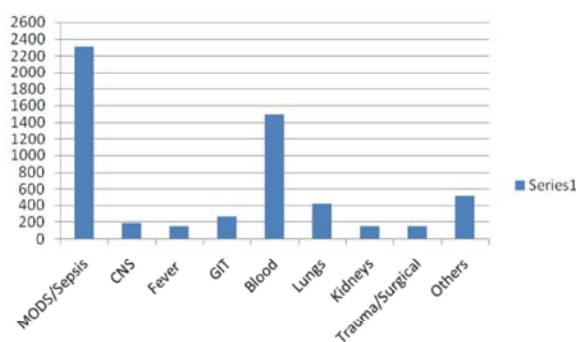
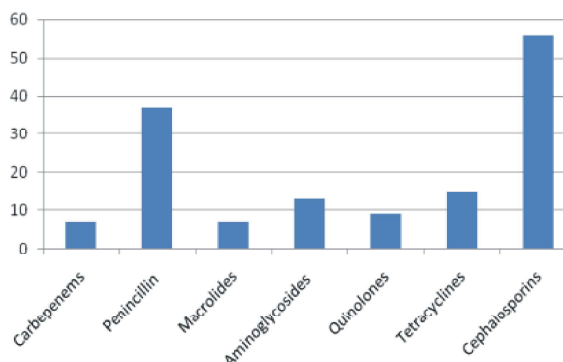


Fig. 2: Comparison of median cost of antibiotics in treatment of disorders affecting various systems

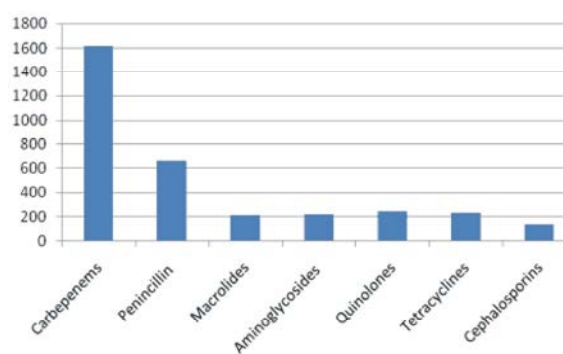
A total of 177 antibiotics were prescribed for the 110 patients studied, that is, an average of 1.60 (± 0.77) antibiotics / prescription. Antibiotics were prescribed for 107 patients (97.27%) at admission. The average number of antibiotics prescribed and the median cost of antibiotics for treatment of Multi Organ Dysfunction Syndrome with Sepsis [MODS/sepsis].

The average cost of antibiotics for each patient suffering from dysfunction involving a system is noted and the median cost of antibiotics for the group is calculated. The cost of antibiotics for treatment of MODS with sepsis was highest.

Cephalosporin's was more commonly prescribed antibiotics in patients and had lowest cost per prescription in patients, although amoxicillin cost was still lower among penicillin group of antibiotics with median price of INR 110, carbapenems was the most expensive drug prescribed among our patients. Oral antibiotics were prescribed in only 10 patients and the median cost was INR 54. On univariate analysis, we found that the average cost of the total drugs prescribed and antibiotics prescribed were significantly lower in younger patients (<45 years). Although the total cost of antibiotics and



(A)



(B)

Fig. 3: The distribution (A) and median cost (B) of various groups of antibiotics

drugs was higher in surgical and trauma patients, this was not a statistically significant compared to medical treatment.

DISCUSSION

Prescriptions of 110 consecutive ICU admissions were audited over a 4-month period to study drug utilization patterns in the ICU. The average age of patients was 44 years and most of the patients were in age group of 30-60 years which is also observed in a study conducted in northern India by aparna *et. al.* [8] In a study on drug use patterns from an ICU in Iran, the average age of patients studied was 50.3 ± 20.4 years [9], which is comparable to present study, but the mean and range of age of patients in ICU in a study conducted in Netherland was 61 (16-93) years and the difference could be explained by the different socio economic conditions and a longer life expectancy in such a country [10]. The average number of antibiotics per prescription in present study was 1.60 (\pm SD 0.77) which is lower than northern India where an average of 2.09 (\pm SD 1.27)

antibiotics/prescription has been reported. Antibiotics were prescribed on 107 patients (97.27%) at admission, which is again similar 95% reported from a north Indian study, reflecting similar prescription pattern in the country[8]. There are other variable reports of percentage of patients receiving antibiotics at admission in ICU from country ranging from 60% to 80%. The medical cases dominated ICU with 77% admissions compared to surgical and trauma cases, which is not too high compared to around 70% reported from north India. In the present study most of the patients were managed with 1-2 antibiotics (85%) and only 13% received 3-4 antibiotics in ICU, whereas in the northern counter part of the country 70% patients received 2 or less antibiotics, whereas western countries report still lower antibiotic prescription [11]. In our ICU, the most frequently prescribed antibiotics were 3rd generation cephalosporins which is also reported by other studies[8] followed by penicillin's. Metronidazole, cephalosporins and penicillins are most commonly prescribed antibiotics reported by several studies conducted in ICUs of tertiary care hospitals of our country. When we compared the cost of various antibiotics cephalosporins and penicillins had lowest cost per prescription, which is the one of the reasons for wide prescription of these drugs in developing country like India [12-14].

Antibiotic monotherapy is sufficient for most infections. Antibiotics may be combined to prevent the emergence of resistant bacteria at the infection site by rapidly reducing the bacterial inoculum, but this may increase selective pressure on the commensal flora. The prescription of combinations, except in the case of mycobacterial infections, must be strictly limited to the following well-defined situations. The higher rates of prescribing antibiotics in our Institute could be because it is tertiary hospitals with most of the critical patients referred from other centres. The severity of disease and age are the most important factors contributing to antibiotic prescription at admission in the ICU, with the average number and cost of antibiotics/prescription greater for MODS/Sepsis and for patients aged more than 45 years. The empirical therapy is continued in most cases and the need for changing prescribed antibiotics was less common in our hospital. In conclusion, our study reveals that antibiotics continue to be widely prescribed in the ICU. The elderly patients with severe diseases with multiorgan involvement are prescribed more antibiotics, resulting in more cost per prescription. The prescription pattern was similar to that reported from other parts of country. There is a strong need for guidelines and

protocol for treatment at all levels of health care especially with respect to antibiotics along with regional and institutional policies to cater to local needs and availability.

REFERENCES

1. Gagneja, D., N. Goel, R. Aggarwal and U. Chaudhary, 2011. Changing trend of antimicrobial resistance among gram-negative bacilli isolated from lower respiratory tract of ICU patients: A 5-year study. *Indian J. Crit. Care Med.*, 15(3): 164-167.
2. Antibiotic Expert Group, Therapeutic guidelines: antibiotic, Version 14, Melbourne: Therapeutic Guidelines Limited; 2010.
3. Susmitha, S., K.K. Vidyamol, P. Ranganayaki and R. Vijayaragavan. Phytochemical Extraction and Antimicrobial Properties of *Azadirachta indica* (Neem). *Global Journal of Pharmacol.*, 7(3): 316-320.
4. Yogita, S., A. Prachi, J. Arun and B. Maya, 2013. Antibacterial and Antifungal Activity of Roots of *Wattakaka volubilis*. *Global Journal of Pharmacology*, 7(3): 283-287.
5. Ghias Uddin, Abdur Rauf, Naveed Muhammad, Shabana, Nadia Malik and Mohsina, 2012. Phytochemical and Pharmacological Studies of the Whole Plant of *Calotropis procera*. *Middle-East Journal of Medicinal Plants Research*, 1(4): 71-74.
6. Agu, G.C., M.O. Efuntoyey, B.T. Thomas and A.A. Adegbulu, 2013. Lactic Acid Bacteria and Antibiotics: A Comparative Study of Their Antibacterial Activities. *International Journal of Microbiological Research*, 4(3): 234-240.
7. Ghafur, A., D. Mathai, A. Muruganathan, J.A. Jayalal, R. Kant, D. Chaudhary, K Prabhaskar, O.C. Abraham, R. Gopalakrishnan, V. Ramasubramanian, S.N. Shah, R. Pardeshi, A. Huilgol, A. Kapil, J.P.S. Gill, S. Singh, H.S. Rissam, S.Todi, B.M. Hegde and P. Parikh, 2012. "The Chennai Declaration" Recommendations of "A roadmap- to tackle the challenge of antimicrobial resistance"- A joint meeting of medical societies of India. *Indian J. Cancer*, 49(4): 84-94.
8. Williams, A., A.S. Mathai and A.S. Phillips, 2011. Antibiotic prescription patterns at admission into a tertiary level intensive care unit in Northern India. *J. Pharm. Bioallied Sci.*, 3(4): 531-536.
9. Tavallaee, M., F. Fahimi and S. Kiani, 2010. Drug-use patterns in an intensive care unit of a hospital in Iran: an observational prospective study. *Int. J. Pharm. Pract.*, 18(6): 370-376.

10. Bergmans, D.C.J.J., M.J.M. Bonten, C.A. Gaillard, F.H. Van Tiel, S. Van Der Geesta, P.W. De Leeuw and E.E. Stobberingh, 1997. Indications for antibiotic use in ICU patients: A one-year prospective surveillance. *J. Antimicrob. Chemother.*, 7; 39: 527-535.
11. Meyer, E., D. Jonas, F. Schwab, H. Rueden, P. Gastmeier and F.D. Daschner, 2003. Design of a surveillance system of antibiotic use and bacterial resistance in German intensive care units (SARI) *Infection.*, 31(4): 208-215.
12. Shankar, P.R., P. Partha, A.K. Dubey, P. Mishra and V.Y. Deshpande, 2005. Intensive care unit drug utilization in a teaching hospital in Nepal. *Kathmandu Univ. Med. J.*, 3(2): 130-137.
13. Biswal, S., P. Mishra, S. Malhotra, G.D. Puri and P. Pandhi, 2006. Drug utilization pattern in the intensive care unit of a tertiary care hospital. *J. Clin. Pharmacol.*, 46(8): 945-951.
14. Shrikala, B., K. Kranthi and A. Nafisa, 2010. A prospective study on evaluation of antibiotic prescription practices in an intensive care unit of a tertiary care hospital. *J. Clin. Diag. Res.*, 4: 3387-3391.