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Original Article

Evaluation of Rationality in Prescription Pattern of Antibiotics at a Tertiary Care Centre: An Observational Study

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ABSTRACT

Background: The emergence of resistant microorganisms is caused by the irrational prescription of antibiotics. Despite this, Prescription antimicrobial are on the rise in hospitals. Therefore, this study done with an objective to assess the prescription pattern of antibiotics at tertiary care hospital, to assess the rationality of prescriptions according to WHO (World Health Organization) prescribing indicators and to identify occurrence of poly-pharmacy in prescriptions. **Materials and Methods:** It is a single centre prospective observational study conducted after approval from Institutional Ethics Committee of Anurag University, Hyderabad for 6 months duration. Study includes in-patient departments. Data was collected from patient medication charts, case sheets, nurse notes which were analyzed using descriptive statistics. **Results:** 222 cases collected totally. Male population dominated the study of 63.06%. The average number of drugs prescribed per encounter was 5.07% that is more than the WHO permissible levels. Ceftrioaxone was highest in prescription of 29.67%. Cephalosporin's majorly prescribed in 61.29% cases. More than half of the prescriptions reported drugs prescribed for prophylactic treatment in 51.35%. 65.31% antibiotics given as mono-therapy. 91.89% drugs prescribed via parenteral route. 82.88% prescriptions had brand names written. 97.75% cases were prescribed from the WHO Essential Drug List. **Conclusion:** Over all irrationality was observed. This requires following WHO prescribing indicators optimum values from preventing harmful effects to the patient. By understanding the rational method of prescription, it can help physicians provide cost effective health care treatments.

Keywords: Antibiotics, Ceftriaxone, Mono-Therapy, Prescription pattern, WHO.

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INTRODUCTION

Antibiotics are most commonly prescribed drugs in hospitals worldwide. In a developing country like India healthcare costs are major problem and overuse of antibiotics has economic consequences. Monitoring the use of antibiotics in relation to medical indications can be beneficial to identify irrational use and improve prescribing patterns (Pavithra *et al.*, 2020). The Centre for disease control and prevention-CDC says that over 100 million antibiotic prescriptions are given to people who go to the doctor's office or clinic every year. About 90-95% of staphylococcus bacteria are not affected by penicillin, and in many Asian countries 70-80% of these bacteria are also resistant to methicillin (Vyshnavi *et al.*, 2020). Indiscriminate use of antibiotics leads to adverse drug reactions, less than optimal treatment, treatment failure and poly-pharmacy. Therefore, antibiotic guidelines are necessary to minimize these problems and ensure safety in the hospital (Sabishruthi *et al.*, 2019). According to the World Health Organization-WHO, rational antibiotic usage is defined as the cost-effective use of antibiotics which maximizes clinical therapeutic effect while minimize both drug-related toxicity and the development of Antimicrobial Resistance (AMR) (Atif *et al.*, 2016). Further, the World Health Organization/International Network for Rational Drug Use (WHO/INRUD) has designed outcome indicators related to rational drug use. According to this, 100% of medicines must be prescribed from the Essential Drug List (EDL) of any country. According to the survey of the Medicines Board of Nepal on medicine prescription habit in private medical offices of Kathmandu municipality, it was observed that the proportion of medicines prescribed from EDL was 32.4% and that in Zooni Hospital 42%. In order to effectively promote the rational use of drugs in developing countries, it is important to assess the compatibility of the drug use model with the WHO drug indicators. Thus, knowing where and when errors in rational prescribing are most likely to occur is the first

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step in preventing these errors (Chapagain *et al*., 2016). Most minor bacterial infections get better without use of antibiotics. The Prescribing Model Study found that doctors need to keep an eye on and assess their prescribing patterns in order to provide better and more efficient care for their patients (Remesh *et al*., 2013). Around the world, efforts are being made to reduce the problem of antimicrobial resistance by encouraging its sensible use (Selvaraj *et al*., 2016). Therefore, this research looks at pattern of antibiotics prescribed at a tertiary care hospital. The results of the study might also apply to other hospitals where drug use is considered to be comparable. The study aims to assess whether prescriptions align with WHO prescribing indicators, identify the antibiotics most frequently used in the hospital, and examine the extent to which polypharmacy occurs within the reviewed prescriptions.

MATERIALS AND METHODS

It is a single centre prospective observational study conducted at Yashoda Hospital, Secunderabad, Telangana for a duration of 6 months. The research work was initiated after approval from Institutional Ethics Committee, Anurag University, Hyderabad. The Ethical approval reference number is stated as IRB-AU/2023-2024/10. The study population included patients of age groups (18-75) years hospitalized during the study period. In patient departments of General medicine, Orthopedics, Pulmonology, Nephrology and Gastroenterology were considered for the study. Both male and female gender included. The exclusion criteria consisted of pediatric age group of below 18 years, pregnant women and cancer patients. If patient left hospital in-between the treatment course then was excluded from the study.

Study Procedure

A structured data collection form was prepared to collect demographic details of the patient and medications prescribed. The in-patient department ward rounds done for data collection done on a regular basis. Cases were collected according to inclusion and exclusion criteria and reviewed periodically for completeness of data. All the in-patient cases prescribed with antibiotics were considered as part of the sample size on daily basis. Confidentiality of data maintained. All prescriptions were assessed using WHO prescribing indicators to determine appropriateness of antibiotics prescribed. Further, the appropriateness of antibiotics prescribed was determined using following criteria such as: dose, frequency, duration of treatment, selection of antibiotics prescribed for the medical condition. Cases follow-up was done until discharge. Multi-drug prescriptions were reviewed for poly-pharmacy. Poly-pharmacy was identified when the medications were prescribed with equal to or more than 5 drugs and the optimum number of medications was classified as less than 5 medications in a prescription.

Data Analysis

Interpretation of the data collected was done by using descriptive statistics to determine the mean distribution, frequency and percentages. The data was evaluated to generate the final report.

RESULTS

So, 222 cases were collected from in-patient department which comprised of age group 18-80 years. Research observation reported a total number of drugs prescribed were 1126 and total number of antibiotics prescribed were 264. The majority of cases consisted of General medicine 81, 36.48%. Age wise distribution of patients showed that majority of cases were (57-69) years 61 cases (27.47%) followed by (44-56) years, 58 cases (26.12%). Males observed as predominant gender in 140 cases (63.06%) and 82 cases (36.94%) females. In our study it was seen that Acute Febrile Illness (AFI) (18,8.10%) was the commonly observed medical condition for which antibiotics were prescribed, followed by LRTI-lower respiratory tract infections (14, 6.30%), Cholecystitis (13, 5.85%), Acute GE (11, 4.95%). The study showed that antibiotics were prescribed with proper diagnosis in 114 cases, 51.35% cases. Ceftriaxone was majorly prescribed in 46 cases (29.67%) followed by Metronidazole 36 cases, 23.22% as seen in Table 1. The commonly used fixed dose combination observed was Sulbactum + cefaperazone given in 106, 92.98% cases as seen in Table 2. Among the class of antibiotics its been observed that Cephalosporins were highest prescribed in 95 cases, 61.29% among which Ceftriaxone was commonly given in 46 cases, 48.42%, followed by cefuroxime and meropenem in 16 cases each, 16.84% followed by metronidazole (23.22%), tetracyclines (10.32%) and penicillin (1.93%). The AMA (antimicrobial agents) given as the prophylactic treatment was more (51.35%) compared to given for actual disease treatment 48.16%. Most of the antibiotics in prescription were given as mono-therapy in 145 cases (65.31%) followed by dual therapy 70 cases (31.53%) as seen in Table 3. Parenteral route of drug administration seen in 204 cases (91.89%) majorly that followed oral route of administration in 18 cases (8.10%). As per incidence of severity of DDIs from our study it was seen that 44 cases, 50.57% drugs were of minor severity which did not harm to the patients and next followed by 37 cases, 42.52% major DDIs which had the potential to cause harmful effects to patient. Poly-pharmacy was reported in most number of cases (195 cases, 87.83%). Table 4 reports findings of Antibiotic prescription pattern of this study in comparison to the WHO prescribing indicator guidelines. From this study it was observed that average number of drugs prescribed per encounter was 5.07% which is more than the WHO permissible levels of (1.6-1.8). This may lead to increased drug interactions, bacterial resistance and eventually increasing cost of treatment. Study found that 82.88% cases were prescribed with brand name and less cases with generic name 35, 17.11% which was lower than the standard value of 100% as per WHO prescribing indicator guidelines. In our study 217 cases, 97.75% of drugs prescribed

form EDL which was slightly lesser than 100% mark as per WHO prescribing indicator guidelines.

DISCUSSION

By understanding the rational method of prescription it can help physicians provide cost effective health care treatments. Majority of patients were above 45 years showing adults more susceptible to infections / diseases and thereby the use of antibiotics for them. Male patients were more which may be due to the fact that females were less exposed to environmental conditions causing infections. AFI (18,8.10%) was the commonly observed medical condition that was similar to a study where LRTI was majorly seen medical condition done by (Akram *et al*., 2014) followed by viral infection in study population. Our study findings were contradictory to another study done by (Md. Rabiul *et al.*, 2016) which showed 69% prescriptions were not having proper diagnosis whereas it was lower in this study of 108 cases, 48.6%. Due to presence of infections in this study it necessitated ceftriaxone in various prescriptions as they are broad spectrum antimicrobials whereas another study showed cefepime and tazobactum as most commonly prescribed drugs done by (Rajalingam *et al*., 2016). Also, another study done by (Md. Rabiul *et al.*, 2016) demonstrated maximum prescribed antimicrobicals to be Azithromycin, followed by cefixime, cefuroxime, ciprofloxacin. Prescription of cephalosporins was maximum which was similar to study done by (Patel *et al*., 2024) which also showed cephalosporin class of drugs to be prescribed majorly. This class was mainly prescribed because of its clinical efficacy and favourable and tolerable profiles to the patient. Also, as AFI was common medical condition in our study, it was observed that physicians prescribed antimicrobials due to the reasoning that fever is indicative for bacterial infections. This pattern of prescription is similar to a study done by (Parvathi *et al*., 2017) which demonstrates the same. Prophylactic treatment of AMA was more in this study which was different from another study done by (Vandana *et al*., 2012) that showed AMA given for infection purpose followed by drugs prescribed for symptoms and lastly for prophylactic purpose. However, in our study culture sensitivity tests were not done in many cases and in some the reports were late, so prophylactic prescription of AMA was observed. This pattern of prescription is observed to be inappropriate, but based on patients critical condition the medicine were prescribed and given at the earliest, in order to prevent any further complications to the patients.

Table 1: Total number of antibiotics prescribed.

Sl. No.	Antibiotic name	No. of antibiotics	Percentage
1.	Ceftriaxone	46	29.67%
2.	Metronidazole	36	23.22%
3.	Doxycycline hydrochloride	16	10.32%
4.	Meropenum	16	10.32%
5.	Cefuroxime	16	10.32%
7.	Cefexime	5	3.22%
8.	Cefperazone	5	3.22%
9.	Cefotaxime	5	3.22%
10.	Piperacillin	3	1.93%
11.	Cefepime	2	1.29%
12.	Levoflaxacin	2	1.29%
13.	Clindamycin	2	1.29%
14.	Azithroimycin	1	0.64%
	Total	155	100%

Table 2: Fixed dose combination of Antibiotics prescribed.

Fixed dose combination	Dose (IV)	Dose (oral)	Number of cases	Percentage %
Sulbactam+cefoperazone	1.5 g (0.5 g + 1 g)	-	106	92.98%
Amoxicillin+potassium clavulanate	1.2 g 1 g + 200 mg	625 (500/125) mg	3	2.63%
Sulfamethoxazole+trimethoprim	80 mg + 400 mg / 5 mL	800 mg / 160 mg	3	2.63%
Piperacillin+tazobactum	4.5 g 4. 0 g + 500 mg	-	2	1.75%

Table 3: Number of antibiotics given per prescription.

Antibiotics per prescription	Number of cases	Percentage
Mono therapy	145	65.31%
Dual therapy	70	31.53%
Triple therapy	6	2.70%
Quadraple therapy	None	0%
More than 5	1	0.45%
Total	222	100%

Table 4: WHO prescribing indicator values from study.

Indicator	Study Result	Optimal Level
Average number of drugs per encounter	5.07%	1.6-1.8
Average number of drugs prescribed by generic name	17.11%	100%
Average number of Antibiotics prescribed	23.44%	20.0%-26.8%
Average number of Injections prescribed	91.89%	13.4-24.1%
Average number of drugs from EDL	97.75%	100%

Monotherapy was considered more in this study which prevents any Drug-Drug Interactions (DDIs) or antibiotic resistance. This was similar to a study done by (Yimenu *et al*., 2019) which also reported maximum prescriptions as mono-therapy. Parenteral route mostly given because it required faster onset of action of the therapeutic outcome, and hospitalized patients are preferred to be administered with IV antibiotics, primarily. This was in coincidence with other study which also showed IV antibiotics prescribed in majority of 74.53% cases conducted by (Patel *et al*., 2024). DDIs of minor severity was more in this study whereas another study done by (Rajalingam *et al*., 2016) demonstrated that moderate severity of DDI was more in the cases. Polypharmacy in our study may be attributed to the increased prescription of antibiotics without proper culture-sensitivity tests as per causative micro-organism findings causing the medical-condition. This was similar to study done in Nepal by (Basnets *et al*., 2016) which also reported around 86.66% of patients with poly-pharmacy. This could lead to development of super-infections, increasing patient cost. Hence, poly-pharmacy must be avoided as much as possible in the prescriptions. Writing prescriptions in generic name is considered rational and economical, but in this study, it was of less percentage. Prescribing in generic names helps avoid confusion among pharmacist, while dispensing medications. This was in similarity with another study done by (Abhijit *et al*., 2014) which showed no drugs being prescribed in generic name in the IP-wards. In our study 23.44% of antibiotics were prescribed which was between the permissible range of (20%- 26.8%) whereas another study done by (Atif *et al*., 2016) showed 52.2% of antibiotics prescribed which was high. Therefore, it can be said that more antibiotic prescriptions were due to infections commonly occurring in in-patient department which requires prophylactic and empirical basis of prescription. However, in our study it was in the WHO range. In this study it was seen that 91.29% of injections were prescribed in our cases, which was much higher than the optimal ranges (13.4-24.1). Generally, injections are administered to a patient when oral routes are not possible but sometimes also given due to need of immediate onset of action to alleviate the symptoms of medical condition. However, excess use of injections may also cause allergic reactions at site of administration and also increase the cost of treatments to the patient as they are expensive and may lead to blood borne diseases. Rational prescription includes optimal use of drugs from WHO EDL as they are genuine, and show less harmful effects on patients and at low cost available. In our study most of the drugs were prescribed from the EDL but however, there was a slight deviation which maybe attributed to the fact that prescription of new and branded drugs has became more.

LIMITATIONS OF STUDY

Our study included only in- patients and did not consider out-patients. Study was for a shorter duration so can be extended for more time. It did not include antibiotics prescribed in pediatric population, which can also be considered for future studies.

CONCLUSION

Due to delays in culture sensitivity tests empirical antibiotic therapy was seen to be prescribed, whereas in some cases no culture sensitivity tests was done due to immediate treatment requirement. So, broad spectrum antibiotics were commonly seen in prescriptions with cephalosporins and fixed dose combinations. As antibiotic resistance is increasing and leading to morbidity, mortality and increased treatment cost, it is important to create awareness and regulate the use of antibiotics among healthcare professionals by knowing about the pathogen prevalence and resistance patterns in their hospital set up. Physicians must also counsel the patients on appropriate use of antibiotics and the need to avoid self-medication. Drug utilization studies for antibiotics must be carried out on regular basis to evaluate the prescription patterns.

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ABBREVIATIONS

AFI: Acute febrile Illness; **CDC:** Centre for disease control and prevention; **EDL:** Essential Drug List; **INRUD:** International Network for Rational Drug Use; **WHO:** World Health Organization.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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