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Antimicrobial focused assessment of core drug use indicators using WHO/INRUD methodology in post-operative patients at tertiary care hospital in Rohtak, India

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Abstract

Drug utilization research (DUR) provides the important community data with regards to the pattern of drug use prevalent in the society, identify irrational prescription, indicate overuse, underuse of drugs and their cost effectiveness. A number of indicators have been developed, standardized and evaluated by the World Health Organization (WHO) to evaluate rational use of drugs. These indicators are grouped into three categories namely: prescribing indicators, patient care indicators and facility indicators. The study was aimed to evaluate rational drug use based on WHO-core drug use indicators in tertiary care hospital in post-operative patients. Average number of drugs per prescription was 5.99, Percentage of drugs prescribed by generic name were 50%, Percentage of encounters in which an antibiotic was prescribed was 100%, Percentage of encounters with an injectable were 92.45%, Percentage of drugs prescribed from WHO Essential Medicine List were (EML) 54%. These indicators of antimicrobials per prescription met the WHO optimal use recommendations but prescription of generic drugs and prescription from essential medicine list were found to be lower than the WHO recommendations. Use of Generic medicines and drugs from essential medicine list should be promoted. Government and hospitals should workup to enhance rational use of drugs.

Keywords: Drug utilization research, WHO, Essential medicine.

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1. Introduction

Rational use of drugs is essential for good healthcare system as well as for patent and community. World Health Organization (WHO) defines rational use of medicines as "patients receive medications appropriate to their clinical needs, in doses that meet their own individual requirements, for an adequate period of time, and at the lowest cost to them and their community".[1] Irrational prescription of drugs include practicing unnecessary polypharmacy, using antimicrobials in insufficient amount, for noninfectious reasons, not prescribing in accordance to guidelines, using inappropriate fixed dose combinations and self-medication. Worldwide more than 50% of all medicines are prescribed, dispensed, or sold inappropriately, while 50% of patients fail to take them correctly. WHO recommends use of specific approaches to identify type, amount and reasons of irrational prescribing, so targeted strategies toward the solution can be formulated.[2]

The use of antimicrobial as prophylaxis has led to the prevention of a large number of infections to substantial declines in surgical site infections (SSIs). Analysis has found that the percentage of SSIs caused by gram-negative bacilli decreased from 56.5% in 1986 to 33.8% in 2003.[3] Irrational prescribing particularly in antimicrobials can result devastating outcomes not only for patient but for community as whole, as it leads to antimicrobial resistance. The known bacterial strains are becoming non responsive to current

antimicrobials. Increasing resistance of antimicrobials also increase healthcare cost. A study done by Chaudhary *et al* in total 250 patients, 194 (77.6%) showed bacterial growth of Staphylococcus aureus and Escherichia coli in pus and 39.2% were multi drug resistant.[4] Center for Disease Control's (CDC's) National Healthcare Safety Network (NHSN) is the United States's most widely used healthcare-associated infection tracking system which in their 2006-2007 annual report stated 49.2 % of S. aureus SSI's were multidrug resistant.[5] Between 2000 and 2010, the consumption of antibiotic drugs raised by 36%. Brazil, Russia, India and China and showed 76% of this increase. Cephalosporins and broad-spectrum penicillins were most consumed (55%) in 2010. The most important relative increases from 2010 were observed for monobactams (2031%), glycopeptides (233%), cephalosporins (93%), and fluoroquinolones (64%).[6]

A major step towards rational use of medicines was taken in 1977, first WHO model list of essential medicines was published in the year 1977 which contained 186 medicines. It stated that essential medicines were "of utmost importance, basic, indispensable and necessary for the health and needs of the population" and criteria for selection were based on efficacy, safety, quality and total cost. India's *first* National *List* of Essential Medicines (*NLEM*) of *India* was prepared and released in 1996. NLEM guide safe and effective treatment of priority disease conditions of a population, promote the rational use of medicines, optimize the available health resources of a country. [7]

Another step toward curbing irrational practice was introduction of drug use indicators. The International Network for Rational Use of Drugs and WHO (WHO/INRUD) collaborated to design drug use indicators. These indicators provide insight of rational drug use and its measure the deviation from WHO recommendations.[8]

The purpose of this study was to evaluate the drug use pattern by employing the WHO/INRUD core drug use indicators keeping antimicrobials in foremost focus at the tertiary care hospital of Rohtak district of North Indian state Haryana, India. This research gives insight of antimicrobial prescription pattern in our tertiary care hospital comparing it to global status of antimicrobial use. Observations can also act as baseline to see the effect of health policy implementation over the time.

2. Materials and methods

This was a retrospective observational study conducted in the department of Surgery in collaboration with department of Pharmacology at Pt. BD Sharma PGIMS Rohtak institute. Study was done in accordance with the principles of Declaration of Helsinki and Good clinical practice (ICH-GCP). Approval was taken from Institutional Ethics Committee, PGIMS/UHS, Rohtak before commencement of study.

The prescriptions were studied from case history files of the inward patients. The prescriptions prescribed by physician from post-operative day to the day of discharge were considered. Data collection was done using a predesigned proforma which included patient characteristics such as age, gender, diagnosis, and duration of hospitalization. Prescriptions of post-operative patients between the ages of 18-65 years who underwent selective operative procedure were randomly selected. Complicated emergency cases or patient who absconded/left against medical advice and patient who died post-operatively within 24 hours after surgery were excluded from the study. WHO core drug prescribing indicators including average number of drugs per encounter, percentage of drugs prescribed by generic names, percentage of encounters with an antibiotic, percentage of encounters with an injection and percentage of drugs prescribed from the essential drugs list 2015 of WHO and India were evaluated.

2.1 statistical analyses

Data recorded was entered in Microsoft excel 2013 for analysis. For all the descriptive data, Statistical Package for Social Sciences (SPSS) version 23 was used. The data was expressed as numbers, percentages and Mean ± Standard Deviation (SD). No statistical hypothesis was tested.

4. Results

4.1 Patients characteristics

A total of 1033 prescriptions were screened between December 2017 and January 2019, out of which 305 post-operative prescriptions were selected based upon inclusion criteria. (Table 1)

Table 1: Characteristics of Patients

Gender, n (%)	
Males, n (%)	164 (53.8)
Females, n (%)	141 (46.2)
Age Distribution, n (%)	
18- 30 years	74 (24.3%)
31-50 years	138 (45.12%)
51-65 years	93 (30.5%)
Average age (years)	42.41 ± 14.46
Diagnosis	
Gall bladder disease	74 (24.26%)
Appendicitis	45(14.7%)
Cysts and Nodule	39 (12.78)
Abscess	27 (8.85%)
Others	120 (39.41%)
Duration of Hospitalization	
Maximum duration of hospital stay	27 days
Minimum duration of hospital stay	2 days
Average duration of hospital stay	6.13 ± 2.41 days

4.2 Prescriptions analysis

All the prescriptions consisted of post-operative antimicrobials. Overall numbers of medicines prescribed were 1827 in 305 prescriptions. (Table 2)

Table 2: Prescription analysis of post-operative patients

Parameter	Value (n %)
Total prescriptions	305
Total number of medicines prescribed	1827
Total number of antimicrobials prescribed	634
Total number of non-antimicrobials prescribed	1193
Antimicrobials Groups	
Beta lactams	423 (66.7%)
Imidazoles (Metronidazole)	76 (11.9%)
Aminoglycosides	75 (11.8%)
Quinolones	41(6.4%)
Others	19 (3.2%)
Non-Antimicrobials Groups Used	
Gastric acid suppressing agents	279 (23.3%)
Analgesics	383 (32.1%)
Antiemetics	37 (3.1%)
Multivitamin and Minerals	156 (13.0%)
Antihypertensive agents	32 (2.6%)
Others	306 (25.6%)

4.3 WHO core drug prescribing indicators

WHO core drug use indicators are total 12 in number divided in 3 categories of prescribing indicators, patient care indicators and facility indicators. In this study only prescribing indicators were assessed. (Table 3)

Table 3: WHO Core drug prescribing indicators assessment in surgical post-operative patients

	WHO Core Drug Prescribing Indicators		WHO optimal Values
	WHO Core Indicators	**n (%)**	**n (%)**
1	Average number of drugs per prescription	5.99	1.6–1.8
2	Percentage of drugs prescribed by generic name	914/1827 (50.02%)	100
3	Percentage of encounters in which an antibiotic was prescribed	305/305 (100%)	20.0–26.8
4	Percentage of encounters with an injectable prescribed	282/305 (92.45%)	13.4–24.1
5	Percentage of drugs prescribed from WHO Essential Medicine List (EML)	1003/1827 (54.89%)	100
6	Percentage of drugs prescribed from the National List of Essential Medicine (NLEM)	996/1827 (54.51%)	100
n = 305			
Note: Core drug use indicators optimal values are obtained from World Health Organization source. [23]			

5. Discussion

The information regarding the drug consumption is inadequate in most of the low and middle-income countries.[9] To address irrational use of drug prescribing and dispensing, the use of drugs need to be regularly monitored on an ongoing basis in terms of type and amount of irrational use, along with the reasons for use. In order to quantify the problem many hospitals worldwide have advocated drug utilization studies and WHO core drug use indicators are one part of these studies. Antimicrobials are prescribed usually after surgical procedures to avoid surgical site infections which account for 2-40% mortality worldwide. Surgical site infections prevalence in developing countries is even more.[10]

In this study, the WHO/INRUD drug use indicators were used to identify current treatment practices that may help to resolve problems regarding irrational drug therapy. The results of this study revealed that the average number of antimicrobial drugs per encounter was 2.07, Which is more than other studies. In a study done by Bhadoriya *et al* in Ujjain noted that on an average 1.99 antimicrobial were prescribed per patient.[11] Whereas another study done by Sarraf *et al*, in surgery indoor patients had average 1.23 antimicrobial prescribed per patient.[12] Studies done in intensive care units where patients are at more risk of severe infections show even higher utilization of antimicrobials. Study done in surgery ICU in Ahmedabad showed average 4.02 antimicrobials prescribed per patient.[13] In our study the average antimicrobials per patient was higher as compared to some other studies, which can be due to several factors like hygienic and sanitary conditions of hospital, excess indoor patient burden, antimicrobial prescription policy in hospital.

The parenteral route was the most preferred route overall for all non-antimicrobials as well as for antimicrobials. A study of Ujjain by Bhadoriya *et al* reported 57% use of injectable antimicrobials in hospitalized patients which is closer to our study.[11]

Another study done by Beg *et al* showed similar results in terms of parenteral antimicrobial usage. It reported use of 64.48% parenteral antimicrobials in post-operative patients.[14] Results of our study are lower than a study done in emergency care unit by Shelat *et al* that showed 75% use of parenteral antimicrobials.[15] The above study was performed in emergency care unit so there was more use of injectables to take care of serious infections.

Most of the patients (66.2%) received more than one antimicrobial drug in our study, which is comparable to a study done in Orissa by Patanaik *et al* that showed 68.2 % patients received more than 1 antimicrobial in surgery intensive care unit. The maximum number of antimicrobial used in single patient in our study was 6 which is similar to above mentioned study.[16] Patients are usually prescribed multiple antimicrobials as empirical therapy while the laboratory results are awaited. In the absence of laboratory confirmation regarding the cause of infection, multiple antimicrobials are prescribed to cover the patient against all possible infections. This is not a good practice, as it can lead to development of resistance against many antimicrobial agents.

In our study 54% of the antimicrobials were prescribed from National List of Essential Medicine 2015 and WHO List of Essential Medicine 2015, which is better compared to a Pandey *et al*. done in Nagpur[17] that showed only 38% antimicrobials from NLEM and comparable to Chopra *et al*. in New Delhi that showed 55% antimicrobials from NLEM.[18] The antimicrobials prescribed outside the NLEM were cefuroxime, ceftriaxone sulbactam, cefpodoxime and ornidazole. Cotrimoxazole which is a Fixed Dose Combination (sulfamethoxazole + trimethoprim) listed in NLEM 2015 but combinations of Ornidazole + ofloxacin, Ornidazole + cefixime which were prescribed in this study are not listed in NLEM 2015.

WHO recommends use of 100% generic medicines which was 50.02% in our study. The discrepancy is very large and it depicts real world variation as well. Similar studies have shown use of generic medicine ranging from 10 % to 99%. [19,20] The reason for this variation can be prescriber's belief in branded products, patients preferences, influence of pharmaceutical marketing.

As this study was planned in post-operative patients who are prone to develop SSIs, so prophylactic antibiotics were expected in prescriptions. All the prescriptions (100%) had at least one antimicrobial prescribed. Study done by Arshad *et al* in post-operative patients also reported 99.8 % usage of antimicrobials.[21] Use of antimicrobials for prophylaxis started much earlier in developed countries that significantly decreased their incidence of SSI.[10] In United States, before the routine use of prophylactic antibiotics SSI rates were 13–20% for contaminated wounds and about 40% for dirty wounds. Since the introduction of routine prophylactic antibiotic use, infection rates in the most contaminated groups have reduced drastically.[22]

6. Conclusion

WHO Core indicator of antimicrobials per prescription met the WHO optimal use recommendations but prescription of generic drugs and prescription from essential medicine list were found to be lower than the WHO optimal use recommendations. Drug utilization studies need to be conducted in hospitals regularly and suggestions should be passed on to physicians to stop the spread of antimicrobial resistance, reduce the economic burden on patients and bring the necessary changes in the health policies.

Conflict of interest: None

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