International Journal of Basic & Clinical Pharmacology
Marchiella R et al. Int J Basic Clin Pharmacol. 2024 Jan;13(1):51-56
http://www.ijbcp.com
pISSN 2319-2003 | eISSN 2279-0780

DOI: https://dx.doi.org/10.18203/2319-2003.ijbcp20233891

Original Research Article

Antibiotic utilization profile in surgical ward at secondary government hospital

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Received: 28 November 2023
Revised: 15 December 2023
Accepted: 16 December 2023

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ABSTRACT

Background: This study aimed to determine the profile of the antibiotic utilization in defined daily dose (DDD) units and DU 90% at surgical ward of secondary government hospital in Indonesia within six months period of study.
Methods: A retrospective cross-sectional study was conducted over six months on surgical ward patients prescribed with at least one oral or parenteral antibiotic during hospitalization. Data were collected from pharmacy dispensing data and evaluated using World Health Organization (WHO) DDD. Antibiotics DDD were analysed using DU 90% segmentation in order to know the 90 percent cumulative of antibiotic consumption in surgical ward. WHO prescribing indicators were used to examine the antibiotic prescribing pattern in DU 90% segment.
Results: Out of 319 antibiotic prescribed to surgical ward patients, 219 prescriptions were belonging to DU 90% segment including ceftriaxone (38.94%), moxifloxacin (16.41%), fosfomycin (14.06%), metronidazole (12.43%), and gentamicin (7.69%) in decreasing fashioned. Of the five groups of antibiotics belong to DU90%, ceftriaxone was the highest in DDD (272.5). The average number of antibiotic prescribed to patients were 1.64±0.92. The percentage of antibiotic prescribed by its generic name as well the prescribing of antibiotic from National list of essential medicines were 70.79% and 72.51%, respectively (optimal value 100%).
Conclusions: Our findings on using drug utilization 90% and prescribing indicators are practical for assessing the most widely used antibiotics in ward or hospital setting and to evaluate the quality of prescribing pattern. The antibiotic utilization profile in this study can be used to provide comparative data between hospital and beneficial for future policy making to improve prescribing practice.

Keywords: DU 90%, ATC/DDD, Prescribing indicators, Drug utilization, DUR

INTRODUCTION

Global antibiotic usage has hastened the problem of antimicrobial resistance in public health.[1-4] Antibiotic abuse and/or overuse has long been a public health concern, especially in many low- and middle-income Countries (LMIC).[5-7] Antimicrobial resistance develops naturally, but it is exacerbated globally by antibiotic overuse and misuse.[8,9] Antibiotic resistance rates are increasing primarily due to antibiotic misuse, which will present a significant challenge to the control of infectious diseases in the years to come. Overprescribing antibiotics has been linked to more frequent re-appointments, a higher risk of side effects, and a greater medicalization of illnesses that can heal themselves.[10,11]

The "Global action plan on antimicrobial resistance" has five strategic objectives, which are to increase knowledge and comprehension of antimicrobial resistance, bolster research and surveillance, lower the rate of infection, maximize the use of antimicrobial medications, and

guarantee sustained investment in the fight against antimicrobial resistance.[12] Drug utilization study is important to determine the pattern of antimicrobial medication, thus can be used as baseline data to maximize the use of antimicrobial agents in hospital setting.[13-15]

According to the World Health Organization (WHO), drug utilization evaluation focuses on the social, medical, and economic effects of pharmaceutical distribution, marketing, prescriptions, and use in society.[16] Research on drug use has emerged as a useful instrument for assessing the effectiveness of the healthcare system.[17-19] Drug utilization research's primary goals are to uncover and evaluate issues associated to drug use. Drug utilization research promotes the prudent prescription of medications, advances our understanding of how drugs are currently used in society, to develop guidelines for appropriate medication use, to establish a quality threshold for medication use, investigates if a specific intervention has an impact on drug use by the general public by tracking drug use patterns, and to manage pharmaceutical costs.[16,20]

Drug usage patterns and current conditions are measured using quantitative drug utilization research, or DUR. It entails gathering, arranging, and presenting estimates or measurements of drug use. Typically, the data is utilized to create drug budgets or make judgments. Regarding the quality of drug use, data from quantitative drug use studies are typically suggestive but not definitive.[21,22] The number of medications that make up 90% of drug prescriptions is reflected in the DU 90% segment, along with the segment's adherence to regional or national prescription criteria. To provide a ballpark idea of the quality of prescribing, this broad indicator can be used at many levels (e.g., hospital, region, county, or individual prescriber).[16,23-25]

To prevent the establishment of antibiotic resistance and its detrimental effects on human health, the WHO recommends routine monitoring of antibiotic consumption.[13] At order to look into drug usage at healthcare institutions, in 1993 the WHO and the International network of rational usage of drugs (INRUD) created a list of particular indicators named WHO core prescribing indicators. These metrics consist of the proportion of prescriptions written from the essential drugs list (ideal value 100%), the average number of prescriptions written per consultation (optimal value 1.6–1.8), and the percentage of medications prescribed by their generic names (optimum value 100%).[27]

This study aimed to determine the antibiotic utilization in DDD units and DU 90% segment to quantify trends of antibiotic use in surgical ward patients and assess the quality of antibiotic prescribing pattern.

METHODS

A retrospective cross-sectional study was conducted over six-months period, from April 2023 to September 2023 in surgical ward of Doctor Fauziah Government Hospital in Aceh Province, Indonesia. This study assesses the drug utilization specifically on antibiotic medications utilization. Data used in this study extracted from hospital pharmacy dispensing data and patient's medical records from April 2023 to September 2023. The minimum sample size was calculated using OpenEpi sample size calculator. The studied populations were estimated around 370 patients, thus the minimum sample required were 187 samples (confidence level 95%). The total sampling method was applied with inclusion criteria were patients age ≥12 years old, admitted to hospital over 24 hours, and received at least one oral or parenteral antibiotic regimen during the hospitalization. Incompleted or unrecorded antibiotic dispensing data were excluded. The drug utilization were reviewed using Anatomical Therapeutic chemical/defined daily dose (ATC/DDD) and drug utilization 90% (DU 90%) methodology.[16] The DDD of each antibiotic was calculated based on their ATC code. The DU 90% profile was produced by cumulatively adding all of the antibiotic DDD percentages, sorting them in order of highest to lowest DDD percentage, and then evaluating them using WHO core prescribing indicators. After which the gathered data was descriptively examined. The statistical package for the social sciences (SPSS) version 21 was used to analysed the data descriptively. Research was conducted with approval by the research ethics committee of Universitas Sumatera Utara's Faculty of Medicine No 990/KEPK/USU/2023.

RESULTS

A total of 192 patients who received antibiotic medications during study period were included. Among the patients who received antibiotic prescription were mostly man 58.44% (112 patients). Most of them admitted to hospital because of skin and soft tissue infections 65.63% (126 cases) including cellulitis, gangrene diabetic, and other type of skin infections. Most of patients hospitalized for ≤7 days 83.33% (160 patients) and received less than three of different antibiotic prescriptions 84.90% (163 patients). A total of 319 antibiotics prescriptions were prescribed as empiric and prophylactic indication (87.15% and 12.85%) respectively (Table 1).

There were seven different classes of antibiotic used, included third generation of cephalosporin, fluoroquinolones, phosphonic group, carbapenem, aminoglycoside, lincosamide and imidazole. Each of antibiotics included in this study were classified using anatomical therapeutic chemical (ATC) index (Table 2).

A total volume of prescriptions was ranked from the highest to the lowest according to the number of each antibiotic prescriptions received by patients during study period. The intravenous ceftriaxone (111 prescriptions) followed by fosfomycin (79 prescriptions) and moxifloxacin (44 prescriptions) were among the highest antibiotic prescribed to patients. Cefotaxim were among the least antibiotic prescribed to patients in parenteral form (7 prescriptions) out of 319 prescriptions (Figure 1).

Table 1: Demographic characteristics of patient.

Characteristics	n=192	Percentage
Gender		
Male	112	58.44
Female	80	41.67
Age (years)		
12-18	26	13.54
19-39	49	25.52
40-59	67	34.90
≥60	50	26.04
Length of stay (days)		
≤7	160	83.33
>7	32	16.67
Infections type		
Intra abdominal	44	22.92
Skin and soft tissue infection	126	65.63
Others	22	11.46
Number of antibiotics prescribed		
<3	163	84.90
≥3	29	15.10
Antibiotic prescriptions		
Indication of antibiotic prescriptions	n=319	
Prophylactic	41	12.85
Empiric	278	87.15
Definitive	0	0

Ceftriaxon were the most widely antibiotics given to the patients in units fashioned (522 units). The defined daily dose (DDD) and drug utilization (DU 90%) index was used for quantifying antibiotic use. The antibiotics ranked according to its DDD from the highest to the lowest DDD, it was ceftriaxone followed by moxifloxacin and fosfomycin (Table 3). The cumulative DU90% of antibiotics DDD included five antibiotics, ceftriaxone (272.5 DDD), moxifloxacin (114.84 DDD), fosfomycin (98.38 DDD), metronidazole (87 DDD) and gentamicin (53.81 DDD) in decreasing fashioned (Figure 2).

Among skin and soft tissue infections (SSTI), ceftriaxone followed by fosfomycin and moxifloxacin were the most antibiotic used. As for Intraabdominal type of infections, including colic abdomen, cholecystitis, and peritonitis. Fosfomycin were the highest antibiotic prescribed among the patients (Table 4).

There were 1224 units of antibiotic out of 291 prescriptions in DU90%. The average number of antibiotic prescribed to the patients per encounter were 1.64±0.92. Among other prescribing indicators such as percentage of antibiotic prescribed in generic name and from National model list of essential medicine of Indonesia 2021 were less than 100 percent (70.79% and 72.51%), respectively (Table 5).

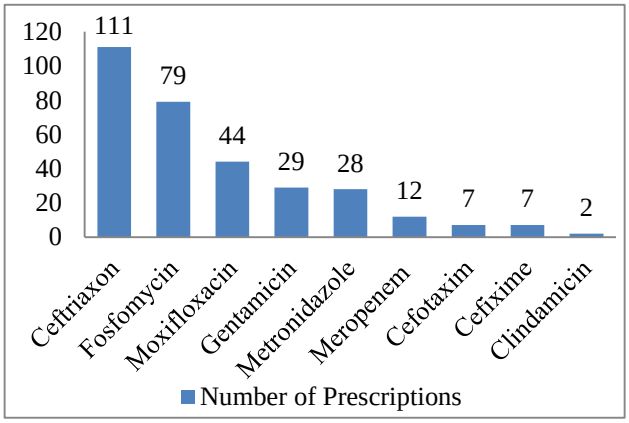

Figure 1: Total antibiotic prescriptions in surgical ward.

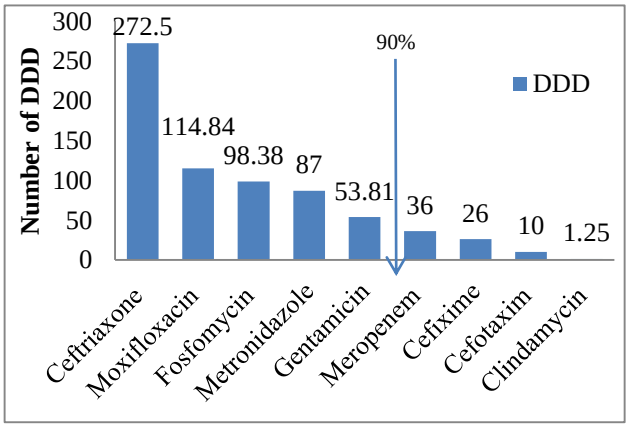

Figure 2: Drug utilization 90% (DU 90%) profiles of antibiotic using DDD.

Table 2: Distribution of antibiotic utilization.

No.	WHO ATC code	Antibiotic	Antibiotic classes	Route	WHO ATC/DDD (g)
1	J01DD04	Ceftriaxone	3rd -generation-cephalosporins	Intravenous	2
2	J01DD01	Cefotaxim	3rd -generation-cephalosporins	Intravenous	4
3	J01DD08	Cefixime	3rd -generation-cephalosporins	Oral	0.4
4	J01MA14	Moxifloxacin	Fluoroquinolones	Intravenous	0.4
5	J01XX01	Fosfomycin	Phosphonic	Intravenous	8
6	J01DH02	Meropenem	Carbapenems	Intravenous	3
7	J01GB03	Gentamicin	Aminoglycosides	Intravenous	0.24
8	J01XD01	Metronidazole	Imidazoles	Intravenous	1.5
9	J01FF01	Clindamycin	Lincosamides	Oral	1.2

Table 3: Antibiotic utilization in units and DDD indicators.

No.	Antibiotics	Units	Percentage	DDD	Percentage
1	Ceftriaxone	522	37.02	272.5	38.94
2	Moxifloxacin	135	9.57	114.84	16.41
3	Fosfomycin	264	18.72	98.38	14.06
4	Metronidazole	178	12.62	87	12.43
5	Gentamicin	125	8.87	53.81	7.69
6	Meropenem	91	6.45	36	5.14
7	Cefixime	60	4.26	26	3.72
8	Cefotaxim	30	2.13	10	1.43
9	Clindamycin	5	0.35	1.25	0.18
Total		1410	100	699.78	100

Table 4: Distribution of antibiotic utilization (DU 90% segment) by cases.

Type of infection and antibiotic	Number of prescriptions (DU 90%)	Percentage
Intra-abdominal infection		
Ceftriaxone	9	3.09
Moxifloxacin	3	1.03
Fosfomycin	18	6.19
Metronidazole	4	1.37
Gentamicin	1	0.34
Skin and soft tissue infection		
Ceftriaxone	97	33.33
Moxifloxacin	37	12.71
Fosfomycin	55	18.90
Metronidazole	23	7.90
Gentamicin	28	9.62
Other		
Ceftriaxone	5	1.72
Moxifloxacin	4	1.37
Fosfomycin	6	2.06
Metronidazole	1	0.34
Gentamicin	0	0
Total	291	100

Table 5: WHO prescribing indicators on DU 90% segment.

Total number of prescriptions (segment DU90%)	291 prescriptions
Total units of antibiotic used	1224 units
Average number of antibiotics used per prescription	1.64±0.92
Percentage of antibiotic prescribed by its generic name	70.79%
Percentage of antibiotic prescribed by its brand name	29.21%
Percentage of antibiotic prescribed from National model list of essential medicine of Indonesia 2021	72.51%

DISCUSSION

Antibiotic are frequently used in surgical practice and come with resistance problems. Antibiotic are useful in targeted, empirical, and prophylactic treatment.[10,28] Concerns about wound contamination during a hospitalization leading to healthcare-associated illnesses (HAIs), worries about the emerge of sepsis, and inadequate infection prevention and control are likely the causes of the elevated level of antibiotic. Several previous studies stated that since 30% of patients will develop post-operative surgical site infections (SSI), this increased the antibiotic utilization.[29-31]

In this study, the most common use of antibiotics was for empirical indication (87.15%). Antimicrobial sensitivity testing was not applicable to identify the causal organism or the drugs to which the bacterium was sensitive because of the facility limitation. Given the rising prevalence of antibiotic resistance, empirical antimicrobial prescriptions should be made carefully.[32] Reducing empirical antibiotic prescriptions is necessary, and creating local antimicrobial guidelines for the use of empirical antibiotics in surgical practice is urgently needed.[29,33]

Several previous studies stated that the largest antibiotic used in the surgical ward was ceftriaxone.[23,34,35] Those findings were in accordance with this study result. According to previous study in 2022 the resistance of third-generation cepahalosporine were already high in South Asia region, especially in Indonesia the resistancy rate already reached 70% to <80%.[32] This can be assumed that there is a possibility of antibiotic resistance from the ceftriaxone overuse in the study setting. The findings in this study might be useful to re-evaluate the effectiveness of ceftriaxone utilization in surgical ward in-patients.

Antibiotic utilization was highest in patients admitted with skin and soft tissue infections condition (65.63%), with ceftriaxone, fosfomycin, moxifloxacin, gentamicin and metronidazole were the most used in decreasing fashioned. In previous studies with same setting, the utilization of ceftriaxone, moxifloxacin, gentamicin and metronidazole were pretty high, this is in line with the study findings.[23,24]

However there were almost no fosfomycin utilization with same setting in recent studies found, only one study found which is not for surgical inpatients, but for internal medicine patient with the very low utilization of fosfomycin, only 2.00 DDD. This might be because the main indication for fosfomycin is to treat urinary tract infection in suspected multidrug resistance organism (MDRO) patients.[36] Compare to this study, fosfomycin utilization in this study were way too high reached 98.38 DDD. Worldwide, prescribing under generic names is advised.[37] The current study's 70.79% prescription usage rate for generic names was less than the WHO's recommended 100% rate. Prescriptions for generic medications are essential in determining the appropriate use of antibiotics.[38] The WHO advises prescription medications under their generic names because it has been demonstrated to be economical and offers patients flexibility when it comes to picking their medications from pharmacies.[39] In the current study, the majority of antibiotic prescribed by brand names were in phosponic and aminoglycoside group (29.21%). These findings resulting in the needed of prescribing guideline policy and routine prescribing quality monitoring for studied setting.

This study only descriptively presents the consumption of antibiotic in DDD and DU 90% manner without analysing its pharmacoeconomic aspects. The DDD and DU 90% is beneficial to know which group or type of antibiotic mostly used in certain ward or hospital setting as it is useful for antimicrobial stewardship update data. But in order to optimize the economic aspect of antibiotic utilization, it is important to analysed its pharmacoeconomic perspective.

CONCLUSION

This study found that the utilization of antibiotic in the surgical ward hospital setting were highest in ceftriaxone followed by moxifloxacin, fosfomycin, metronidazole and gentamicin. The quality of antibiotic prescribing still lower than WHO standard. Our findings provide a baseline data which may beneficial for the policy making related prescribing guidelines on antibiotic use in order to increase the optimalization of antibiotic utilization as well the quality of its prescribing.

ACKNOWLEDGEMENTS

Authors would like to thank all the pharmacists in the hospital studied who had been so helpful in providing the data in this research project.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Marchiella R, Khairunnisa K, Wiryanto W. Antibiotic utilization profile in surgical ward at secondary government hospital. Int J Basic Clin Pharmacol 2024;13:51-6.