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Evaluation of Antibiotic Use in Typhoid Fever Patients at Mitra Sejati General Hospital Using the ATC/DDD Method

Masiria Ndruru[1], Nerly Juli Pranita Simanjuntak[1,2*], Razoki Razoki[1,2]
[1]Department of Clinical Pharmacy, Faculty of Medicine, Dentistry and Health Sciences, Universitas Prima Indonesia, Medan, 20118, Indonesia
[2]PUI Phytodegeneratif and Lifestyle Medicine Universitas Prima Indonesia.
Corresponding author: nerlyjulisimanjuntak24@gmail.com

Abstract

Inappropriate use of antibiotics can have negative effects, such as triggering resistance, worsening patient conditions, and increasing the burden on health services. Therefore, evaluation of antibiotic use through the Anatomical Therapeutic Chemical/Defined Daily Dose (ATC/DDD) approach is necessary to assess the rationality of therapy, including in cases of typhoid fever, which is still highly prevalent in Indonesia. Objective: To evaluate antibiotic use in typhoid fever patients at Mitra Sejati General Hospital using the ATC/DDD method. This study is a descriptive cross-sectional study using health records of typhoid fever patients currently hospitalized from January to March 2024. The sample size was 72 patients selected using purposive sampling. The results were compared with WHO standards. Findings: Ceftriaxone (34.7%), levofloxacin (19.4%), and cefixime (16.7%) were the most frequently prescribed antibiotics. Based on the ATC/DDD method, only levofloxacin was in line with WHO standards, while the other nine antibiotics showed non-compliance with WHO standards. Conclusion: Antibiotic use was applied to typhoid fever patients at Mitra Sejati General Hospital using the ATC/DDD method, and the results of antibiotic use were classified into two categories: compliant and non-compliant.

Keywords: Typhoid, antibiotics, ATC/DDD

Abstrak

Pemakaian antibiotik yang tidak sesuai dapat menimbulkan dampak negatif. Memicu ketahanan, memperburuk kondisi pasien, dan meningkatkan beban pelayanan kesehatan. Oleh karena itu, evaluasi penggunaan antibiotik melalui pendekatan Anatomical Therapeutic Chemical/Defined Daily Dose (ATC/DDD) sangat diperlukan untuk menilai rasionalitas terapi, termasuk pada kasus demam tifoid yang masih tinggi prevalensinya di Indonesia.Tujuan: untuk mengevaluasi penggunaan antibiotik pada pasien demam tifoid di RSU Mitra Sejati berdasarkan metode ATC/DDD. Penelitian ini merupakan studi deskriptif dengan desain cross-sectional menggunakan biodata kesehatan pasien terkena demam tifoid saat ini dirawat dirumah sakit pada bulan Januari sampai Maret 2024. Jumlah sampel 72 pasien yang dipilih dengan teknik purposive sampling. membandingkannya dengan standar WHO. Hasil: Ceftriaxone (34,7%), levofloxacin (19,4%), dan cefixime (16,7%) merupakan antibiotik yang paling sering diresepkan. Berdasarkan metode ATC/DDD, hanya levofloxacin yang sesuai dengan standar WHO sedangkan sembilan antibiotik lainnya menunjukkan ketidak sesuaian dari standar WHO..Kesimpulan: penggunaan antibiotik telah diterapkan pada pasien demam tifoid di RSU Mitra Sejati dengan Metode ATC/DDD dan hasil penggunaan antibiotik diklasifikasikan kedalam dua kategori yaitu yang sesuai dan tidak sesuai.

Kata Kunci: *Tifoid, antibiotik, ATC/DDD*

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INTRODUCTION

Typhoid fever is an infectious disease caused by *Salmonella typhi*, primarily transmitted through the consumption of food or water contaminated with feces or urine from infected individuals. The disease is often associated with poor hygiene, environmental pollution, and inadequate sanitation. High fever in typhoid is due to the presence of large numbers of bacteria in the bloodstream[1]

According to the World Health Organization (WHO), advances in antibiotic use have significantly reduced morbidity and mortality from typhoid fever in developed countries. However, the disease remains a major public health challenge in many developing regions, including Africa, Southeast Asia, the Eastern Mediterranean, and the Western Pacific. In 2019, an estimated 9 million people were affected by typhoid fever globally, with approximately 110,000 deaths recorded [2]

In Indonesia, typhoid remains prevalent, with an estimated incidence of 350 to 810 cases per 100,000 population. The prevalence reaches 1.6%, ranking fifth among communicable diseases affecting all age groups, with a case proportion of 6.0%. It is also the 15th leading cause of death across all age groups in Indonesia, with 1.6% of deaths attributed to the disease. Most cases occur in individuals aged 3–19 years[3]

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In North Sumatra Province, the proportion of typhoid fever cases is reported at 0.9%, with district-level variations ranging from 0.2% to 0.3%. South Nias Regency recorded the highest rate (3.3%), while Sibolga City reached 0.6%. According to the North Sumatra Provincial Health Profile (2022), typhoid fever ranked fourth among the most common inpatient diseases in hospitals, accounting for 11.182% of total hospitalizations [4].

Antibiotics are indicated for bacterial infections and are essential in managing typhoid fever. Patients exhibiting symptoms of bacterial infections should receive appropriate antibiotic therapy[5]. A previous study titled *Evaluation of Antibiotic Use in Typhoid Fever Patients Using the ATC/DDD Method* found that with an average treatment duration exceeding 0.96 days, the two most frequently used antibiotics were ceftriaxone (59%) and cefotaxime (41%). The DDD per 100 patient-days for these antibiotics exceeded WHO standards—50.1 for ceftriaxone and 20.2 for cefotaxime—indicating irrational antibiotic use at RSUD[6,7].

This evaluation can be conducted using a quantitative approach with the Anatomical Therapeutic Chemical (ATC)/ Defined Daily Dose (DDD) method. The ATC system classifies active substances based on their therapeutic target site, while DDD quantifies standard daily doses associated with ATC codes[7]. The ATC/DDD method is considered effective in reflecting antibiotic usage patterns in specific populations, providing valuable data to support future infection control strategies[8]

A government hospital in Bali evaluated antibiotic use using the ATC/DDD approach, revealing that ceftriaxone, levofloxacin, and azithromycin exceeded the WHO-recommended DDD/100 patient-days limits—recording values of 83.80, 27.47, and 3.52, respectively[9].

Based on the issues presented, the authors conducted this study titled "Evaluation of Antibiotic Use in Typhoid Fever Patients Using the ATC/DDD Method at Mitra Sejati General Hospital." The aim of this study is to analyze antibiotic use patterns in typhoid fever patients and to evaluate the appropriateness of indications, patient selection, drug choice, and dosage using the ATC/DDD method.

METHODOLOGY

Type of Research

This study is a non-experimental study using a descriptive research method. Data collection was carried out retrospectively. Where data was obtained from prescriptions for the period January-March 2024

Location and Time of Research

This research is located at Mitra Sejati Hospital in March 2024.

Population

The population in this study consisted of all medical record data of typhoid fever inpatients at Mitra Sejati General Hospital. During the period of January to March 2024, a total of 88 patients were recorded [10].

Sample

Samples were taken from the population as representatives possessing similar characteristics, allowing research to be conducted with a more limited number of subjects.

Inclusion criteria:

1. Typhoid fever patients who received antibiotic therapy in the inpatient unit at Mitra Sejati General Hospital during the period of January–March 2024.

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2. Typhoid fever patients aged 18 years and older.
3. Typhoid fever patients with complete and legible medical records relevant to the focus of the study.
4. Patients who underwent inpatient care for a minimum of 3 days.

Exclusion criteria:

1. Typhoid fever patients with incomplete or unclear medical record data.
2. Patients with missing or insufficient medical record information.

Analysis Data

This study employed a descriptive design to objectively portray the condition of antibiotic use in typhoid fever treatment. Data were obtained from medical records, including information on patient gender, age, type and class of antibiotics used. Once collected, the data were reviewed for completeness, tabulated, and processed to calculate percentages (%). The collected medical record data were analyzed using SPSS software, and the results were presented in tables with percentage distributions.

RESULT AND DISCUSSION

The research was conducted at Mitra Sejati General Hospital from December to March, with a total sample of 72 patients. Data evaluation was performed using general frequency distribution, including variables such as gender and age.

Characteristic patient

Characteristic patient are presented in Table 1. Based on the results of Table 1, the distribution of typhoid fever patients at Mitra Sejati General Hospital by gender was dominated by males, totaling 46 individuals (63.9%), while females accounted for 26 individuals (36.1%). In terms of age range, the majority of typhoid fever patients were adults aged 31–60 years, comprising 46 individuals (63.9%), while those aged 18–30 years (adolescents to young adults) accounted for 26 individuals (36.1%).

Based on the results of Table 2, the concomitant medications used by typhoid fever patients at Mitra Sejati General Hospital varied. Paracetamol and Domperidone were the most commonly used, each prescribed to 7 patients (9.7%). Ranitidine and Vitamin C were administered to 5 patients (6.9%), while antacids were given to 4 patients (5.6%). Sucralfate and Santagesic were each used by 3 patients (4.2%). Methylprednisolone, Betahistine, and Ibuprofen were used by 2 patients (2.8%) each. These medications served as supportive therapy alongside the main antibiotic treatment for typhoid fever. Cetirizine was used by 3 patients (4.2%), while Ondansetron was administered to 5 patients (6.9%). Vitamin B complex + B12 was given to 2 patients (2.8%), and both Lansoprazole and Lactulose were used by 3 patients (4.2%) each. Amlodipine was prescribed to 5 patients (6.9%), Bisoprolol to 4 patients (5.6%), and Omeprazole also to 4 patients (5.6%). Additionally, Loperamide was used by 2 patients (2.8%) and Ambroxol by 1 patient (1.4%). These medications were used as supportive therapy based on each patient's clinical condition

Table 1. Characteristic patient

Characteristic	Frequency (F)	Percentage (%)
Gender		

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Male	46	63.9
Female	26	36.1
Total	**72**	**100**
Age		
18–30 years	26	36.1
31–60 years	46	63.9
Total	**72**	**100**

Table 2. Concomitant Medications

No	Other Medications	Frequency (F)	Percentage (%)
1	Ranitidine	5	6.9
2	Santagesic	3	4.2
3	Methylprednisolone	2	2.8
4	Paracetamol	7	9.7
5	Antacid	4	5.6
6	Sucralfate	3	4.2
7	Vitamin C	5	6.9
8	Domperidone	7	9.7
9	Betahistine	2	2.8
10	Ibuprofen	2	2.8
11	Cetirizine	3	4.2
12	Ondansetron	5	6.9
13	Vitamin B Complex + B12	2	2.8
14	Lansoprazole	3	4.2
15	Lactulose	3	4.2
16	Amlodipine	5	6.9
17	Bisoprolol	4	5.6
18	Loperamide	2	2.8
19	Omeprazole	4	5.6
20	Ambroxol	1	1.4
	Total	**72**	**100**

Table 3. Type of Antibiotic used

No	Antibiotic	Frequency (F)	Percentage (%)
1	Ceftriaxone	25	34.7
2	Levofloxacin	14	19.4
3	Cefixime	12	16.7
4	Clindamycin	6	8.3
5	Metronidazole	5	6.9
6	Ceftazidime	2	2.8
7	Azithromycin	1	1.4
8	Cipromid	3	4.2
9	Cefotaxime	2	2.8
10	Cefadroxil	2	2.8
	Total	**72**	**100**

Table 4. Type of Antibiotic used

No	Type of Antibiotic	ATC Code	Route	WHO DDD	Patient Usage DDD

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1	Ceftriaxone	J01DD04	Parenteral (P)	2	1
2	Levofloxacin	J01MA12	Oral (O)	0.5	0.5
3	Cefixime	J01DD08	Oral (O)	0.4	0.2
4	Clindamycin	J01FF01	Oral (O)	1.2	0.3
5	Metronidazole	J01XD01	Parenteral (P)	1.5	0.5
6	Ceftazidime	J01DD02	Parenteral (P)	4	2
7	Azithromycin	J01FA10	Oral (O)	0.3	0.5
8	Cipromid (Ciprofloxacin)	J01MA02	Oral (O)	1	0.5
9	Cefotaxime	J01DD01	Parenteral (P)	4	1
10	Cefadroxil	J01DB05	Oral (O)	2	0.5

Based on Table 3, the most frequently prescribed antibiotic for typhoid fever patients at Mitra Sejati General Hospital was Ceftriaxone, administered to 25 patients (34.7%). This was followed by Levofloxacin, used by 14 patients (19.4%), and Cefixime, prescribed to 12 patients (16.7%). Clindamycin was given to 6 patients (8.3%), Metronidazole to 5 patients (6.9%), and Cipromid to 3 patients (4.2%). Other antibiotics used included Ceftazidime, Cefotaxime, and Cefadroxil, each prescribed to 2 patients (2.8%), while Azithromycin was used by 1 patient (1.4%).

Based on Table 4, ten types of antibiotics were used for typhoid fever patients at Mitra Sejati General Hospital from January to March 2024. The DDD values for each antibiotic were compared to WHO standards. Levofloxacin matched the WHO DDD standards, while Ceftriaxone, Cefixime, Clindamycin, Metronidazole,Ceftazidime, Azithromycin, Cipromid (ciprofloxacin), Cefotaxime, and Cefadroxil deviated from them. This indicates that only one antibiotic were used appropriately according to the WHO DDD, while the others showed inconsistencies.

This study evaluated the use of antibiotics in typhoid fever patients at Mitra Sejati General Hospital using the ATC/DDD method during the period of January to March 2024, with a total sample of 72 patients who met the inclusion and exclusion criteria. The majority of typhoid fever cases were found in male patients, totaling 46 (63.9%), while female patients numbered 26 (36.1%)[11]. The higher prevalence in males may be associated with their greater involvement in outdoor activities, which increases exposure to contaminated food or drink. In contrast, females tend to pay more attention to hygiene, which may serve as a protective factor. These findings are consistent with a study by Mardika Intan Setya Putri (2022) at Ibnu Sina Hospital Makassar, which also reported a higher incidence in males[12].

In terms of age distribution, most patients were adults aged 31–60 years (63.9%), followed by those aged 18–30 years (36.1%). This productive age group is often involved in high-mobility activities, increasing their risk of exposure to unsanitary food and water[13]. Additionally, busy lifestyles may lead to neglect of hygiene practices. These results differ from Putri's study, which found the highest incidence in the adolescent group (15–24 years). The predominance of older adults in this study may also reflect a greater tendency among them to seek medical care at health facilities.

Regarding concomitant medications, Paracetamol and Domperidone were the most commonly used (9.7% each), while Ambroxol was the least used (1.4%). These medications served as supportive therapy to manage symptoms such as fever, headache, nausea,

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and vomiting, in addition to antibiotic treatment[14].

Ceftriaxone was the most frequently prescribed antibiotic (34.7%), followed by Levofloxacin (19.4%) and Cefixime (16.7%). This is consistent with a study by Dirga (2021) at RSUD Dr. H. Abdul Moeloek, which also identified Ceftriaxone as the most frequently used antibiotic[15].

Using the ATC/DDD method, only levofloxacin was found to comply with WHO DDD standards. In contrast, Ceftriaxone, Cefixime, Clindamycin, Metronidazole, Ceftazidime, Azithromycin, Cipromid, Cefotaxime, and Cefadroxil exceeded the standard DDD values. These deviations suggest potential irrational use of antibiotics. Overuse may stem from empirical prescribing without microbiological testing or culture. Selective antibiotic prescribing based on microbial sensitivity is essential to minimize unnecessary use and align with rational antibiotic use principles[16].

CONCLUSION

The evaluation of antibiotic use in typhoid fever patients at Mitra Sejati General Hospital using the ATC/DDD method revealed that only one antibiotic—Levofloxacin was used in accordance with WHO DDD standards. The remaining antibiotics, including Ceftriaxone, Cefixime, Clindamycin, Metronidazole, Ceftazidime, Azithromycin, Cipromid, Cefotaxime, and Cefadroxil showed deviations from these standards. These findings indicate that the majority of antibiotic use in typhoid fever treatment at the hospital was not fully aligned with rational use guidelines. Therefore, strengthening monitoring systems and promoting awareness of rational antibiotic use are essential to improve treatment effectiveness and prevent antibiotic resistance.

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