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Antibiotic Prescribing Pattern in Patients with Diabetes Mellitus Complications in Panembahan Senopati Bantul Hospital

(Pola Peresepan Antibiotik pada Pasien Komplikasi Diabetes Melitus di RSUD Panembahan Senopati Bantul)

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Abstract: Diabetes Mellitus, one of the non-communicable diseases (NCDs), is the leading cause of death in addition to cardiovascular disease, cancer, and chronic respiratory disease. The Basic Health Research (Riskesdas) recorded that Yogyakarta experienced a prevalence increase of 97% in 2013-2018, the second-highest in Indonesia. Uncontrolled sugar levels cause deterioration of the immune system. This study aims to determine the pattern of prescribing antibiotics and the occurrence of comorbid complications, both infectious and non-infectious. This was a non-experimental descriptive study with a cross-sectional design. The data was collected from patient's medical records retrospectively from July to December 2019. Furthermore, 65 medical records were taken using a simple random sampling method. A descriptive statistical analysis was performed, and the results were presented as percentages. The percentage of infectious and non-infectious comorbid diabetes mellitus II in Panembahan Senopati Bantul Hospital was 22.2% and 77.8%, respectively. The prescribing pattern primarily used was ceftriaxone (23.5%). The antibiotic class mainly prescribed was cephalosporin (49%).

Keywords: Antibiotics, comorbidities, complications, diabetes mellitus, infection

Abstrak: Diabetes mellitus, salah satu dari penyakit tidak menular (PTM), merupakan penyebab utama kematian selain penyakit kardiovaskular, kanker, dan penyakit pernapasan kronis. Hasil RISKESDAS menunjukkan prevalensi diabetes melitus 2013–2018 tertinggi di Indonesia, data di Daerah Istimewa Yogyakarta mengalami peningkatan 97% dan merupakan tertinggi kedua secara nasional. Kadar gula yang tidak terkontrol menyebabkan sistem imun menurun sehingga meningkatkan resiko terjadi infeksi jika tubuh terpapar oleh suatu kuman penyakit. Penelitian ini bertujuan mengetahui pola peresepan antibiotik serta mengetahui adanya penyerta baik infeksi maupun non infeksi. Penelitian dilakukan secara deskriptif non-eksperimental dengan rancangan potong lintang, data yang diambil berupa rekam medis pasien secara retrospektif bulan Juli-Desember 2019. Sebanyak 65 rekam medis diambil dengan metode *simple random sampling*. Dilakukan analisis statistik deskriptif dan hasil disajikan dalam bentuk persentase. Dihasilkan persentase penyakit penyerta kelompok infeksi pada Diabetes Melitus II di RSUD Panembahan Senopati Bantul sebanyak 22,2% dan kelompok non infeksi 77,8%, Terapi antibiotik terbanyak adalah seftriakson yaitu sebesar 23,5% dari keseluruhan antibiotik dan jika dianalisis berdasarkan golongan, sebagian besar antibiotik yang digunakan adalah golongan sefalosporin (49%).

Kata kunci: Antibiotik, diabetes melitus, infeksi, komplikasi, penyakit penyerta

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INTRODUCTION

THE PREVALENCE of diabetes mellitus in Indonesia continues to increase significantly[1]. Based on the results of the primary health research in 2018, the prevalence of diabetes mellitus from 2013-2018 experienced an increase of 97% from all regions in Indonesia, one of which was the Special Region of Yogyakarta, which in 2018 was the second highest area with the highest prevalence of diabetes mellitus in Indonesia[1].

Diabetes mellitus is closely related to the increased risk of infection in people with diabetes mellitus, so it is necessary to be controlled, not worsen or increase the susceptibility to infection that occurs[2]. Treating infectious diseases cannot be dissociated from antibiotics; antibiotics are chemical compounds produced either synthetically or by microorganisms that can prevent (bacteriostatic) and even kill (bactericidal) the development of bacteria or organisms in the body. Indicators of antibiotic use in hospitals consist of 3 main components, one of which is related to prescription, such as the percentage of the use of one or more antibiotics in inpatients and the average antibiotic prescribed to inpatients. This condition indicates the importance of knowing antibiotic prescribing patterns among inpatients in a hospital[3]. These data are very much needed to be used as information and guidelines for diabetes mellitus management in healthcare facilities.

MATERIALS AND METHODS

METHODS. Research Design. The study was carried out using a non-experimental descriptive research method, and the data was collected in July–December 2019 using retrospective data collection. A cross-sectional design was employed to determine the sample's status in the existing population, including prevalence and the relationship between disease and exposure simultaneously in individuals of a particular people at the same time. The type this study was observational through secondary data in the form of patients' medical records.

Sample Design. The criteria were antibiotics and non-antibiotics prescription patterns of diabetes mellitus patients obtained from Panembahan Senopati Hospital, Bantul; an approach was taken afterward.

Data Analysis. The data from the patient's medical records were collected and then observed using descriptive statistical analysis. The results obtained were presented in the form of a percentage. Then, a conclusion was drawn based on the data processing result.

RESULTS AND DISCUSSION

Patient Characteristics. The patient characteristics are shown on Figure 1. Based on the study's results by gender, the proportion of women was more significant in patients with diabetes mellitus II. This result is similar to the recent research stating that among patients with diabetes mellitus II there are more women than men[4,5]. Riskesdas (Basic Health Research) results also indicate that based on the diagnosis of gender, the proportion of diabetes mellitus II in women is higher than that of men. Previous studies have shown that in women, there is an association between insulin resistance and oestradiol. Estrogens with elevated than average values can be associated with insulin resistance[6]. When reaching menopause, the estrogenic hormone is produced exclusively from androstenedione by the adrenal glands and undergoes aromatization into estrone so that the hormone has more fat tissue. Fat accumulation affects reduced adiponectin protein production. Adiponectin works by making the body's cells more sensitive to insulin. Low adiponectin levels are associated with insulin resistance which can increase blood sugar levels and lead to type 2 diabetes mellitus[7]. Diabetes mellitus in

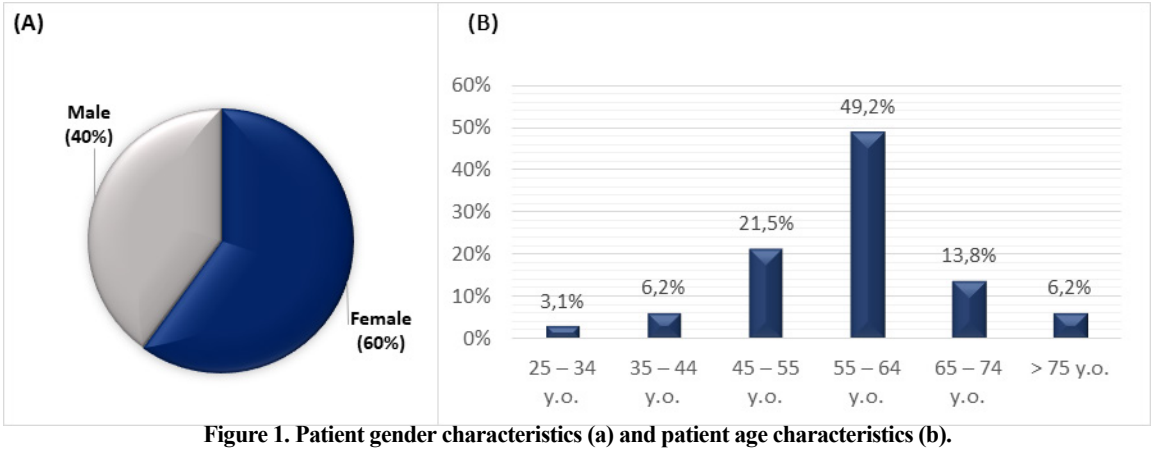

Figure 1. Patient gender characteristics (a) and patient age characteristics (b).

postmenopausal women is influenced by the old age factor, which affects pancreatic β-cells. In addition, decreased physical activity (growth hormone) causes slower body metabolism, and it can cause weight gain and obesity, which will lead to insulin resistance conditions[6].

The results exhibit that most people with diabetes mellitus II range from 55 to 64 years old, and the second-highest range is from 45 to 55. The same results show that the age group of 55-64 is the group with the most diabetes mellitus II[4]. Riskesdas also shows that based on the age of people with diabetes mellitus, the most significant number of sufferers is 55–64[1]. Increased insulin resistance occurs when aging induces a decrease in insulin sensitivity, leading to changes or inadequate compensation of beta-cell function[8].

Comorbidities in Patients with Type DM II. The data obtained from this study showed that the comorbidities in type DM II were 189 from the 65 patient medical records taken. Furthermore, these comorbidities were grouped into 2, namely the infectious group consisting of 6 comorbidities (22.2%) and the non-infectious group, including 13 comorbidities (77.8%) (Table 1).

In some patients, there was not only one comorbidity, but several comorbidities were present, such as unconscious, ketoacidosis, renal complications, neurological complications, and peripheral bleeding. Complications in Diabetes Mellitus II can occur because of several factors, including the length of time the patient has suffered from type DM II, obesity, and regularity in controlling blood sugar[9]. Maintaining blood sugar levels is very influential in the infection occurrence in Diabetes Mellitus II complications because high blood sugar will increase the susceptibility of infection from pathogens to blood sugar levels which has adverse effects on DM patients[2]. Infections are a major concern for diabetics due to the immune system's inability to fight off invading pathogens, according to the American Diabetes Association[10]. Many investigations have been made to identify the pathways connected to diabetes that weaken the host's defense against infections. These processes consist of suppressed cytokine production, phagocytosis flaws, immune cell dysfunction, and failure to eradicate microorganisms[11].

Factors that related to the incidence of complications of diabetes mellitus are obesity (high body mass index/BMI), the duration of suffering from diabetes mellitus, and regular blood sugar control[9]. Complications that frequently occur in diabetes mellitus II are due to uncontrolled hypoglycemia, hyperglycemia, and macrovascular complications in patients who generally have hypertension, dyslipidemia, obesity (coronary heart, cerebral vascular disease, and peripheral vascular disease), and microvascular complications such as retinopathy, diabetic nephropathy, and neuropathy. Generally, infectious comorbidities in diabetes mellitus II are diabetic foot ulcers, tuberculosis, urinary tract infections (UTIs), respiratory tract infections, gastrointestinal infections, soft tissue and skin infections, oral cavity infections, ear infections, and human immunodeficiency virus (HIV) infection[2]. Based on the research results obtained, when compared with existing sources, there is a different pattern of infectious diseases, namely sepsis, caused by a bacterial infection.

Table 1. Percentage of comorbidities in type II DM

Group	Comorbidities	Number (n)	Percentage (%)
Infectious	Diabetes complications	8	4.23
	Liver disorder	5	2.65
	Bacterial infection	6	3.17
	Skin tissue infection	1	0.53
	Urinary tract infection	12	6.35
	Respiratory tract infection	10	5.29
Non-infectious	Diabetes complications	17	8.99
	Kidney diseases	20	10.58
	Liver diseases	1	0.53
	Anxiety	3	1.59
	Indigestion	26	13.76
	Cardiovascular disorders	46	24.34
	Hypoalbuminemia	3	1.59
	Hypokalemia	6	3.17
	Cholesterol disorders	4	2.12
	Accumulation of stomach fluid	1	0.53
	Blood plasma disorders	11	5.82
	Respiratory disorders	2	1.06
	Bones and joints	7	3.70
Total		189	100.00

Use of Antibiotics in Diabetes Mellitus II. The most common antibiotics are third-generation cephalosporins (ceftriaxone), quinolones (moxifloxacin), and metronidazole (Figure 2, Table 2).

The research results from Hajma stated that the most widely used antibiotics were ceftriaxone and metronidazole, with 47.6% of which ceftriaxone is a cephalosporin class of antibiotics[12]. There are similarities between the results of the study and the

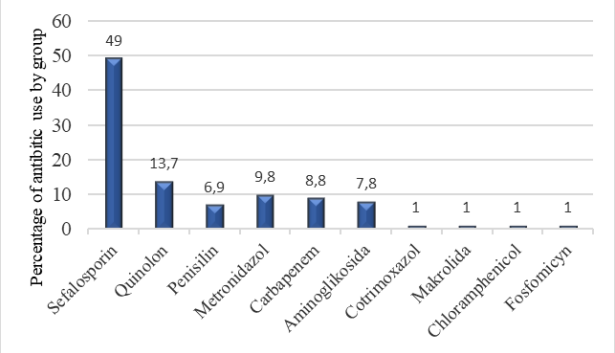

Figure 2. Percentage of antibiotic use by group.

previous studies, indicating that the highest class of antibiotics is the cephalosporins and metronidazole groups. However, the study's results did not state that the quinolones were the highest used in Regional Public Hospital (RSUD) Dr. Moewardi Surakarta because this study only focused on gangrenous ulcer infection. The diagnosis of infection broadly influences the determination of antibiotic prescribing, consideration of possible bacteria causing infection, review of the need for antibiotics, selection of appropriate antibiotics (considering the suitability of the germ spectrum, pharmacokinetic properties, patient contraindications, adverse interactions, and evidence of clinical benefits from use antibiotics), determination of dose, route of administration, duration of administration, and evaluation of drug effects[13]. The percentage of each type of antibiotic use is shown in Table 2.

Table 2. Percentage of antibiotic use.

Medicine name	Frequency (n)	Percentage (%)
Ceftriaxone	24	23.5
Cefotaxime	7	6.9
Ceftazidime	6	5.9
Cefuroxime	5	4.9
Cefoperazone	5	4.9
Cefixime	3	2.9
Moxifloxacin	10	9.8
Ciprofloxacin	3	2.9
Levofloxacin	1	1
Amoxicillin	5	4.9
Sultamisilin	2	2
Metronidazole	10	9.8
Meropenem	9	8.8
Amikacin	8	7.8
Cotrimoxazole	1	1
Azithromycin	1	1
Thiamphenicol	1	1
Fosfomycin	1	1
Total	102	100

Injection or parenteral antibiotics are more widely used because severe infections generally occur in hospitalized patients, and the effects of using these injections are faster. So it is justified as parenteral therapy is necessary for extreme conditions or disorders such as nausea and vomiting[14]. Parenteral administration of drugs has the advantage that the effects are faster and more regular than oral administration. Parenteral therapy can also be given to patients who are unconscious and in an emergency. Meanwhile, the disadvantage is that the toxic effects quickly occur since the drugs are in high doses, and the toxic effect will directly enter the blood and tissues, and the intravenous drug cannot be withdrawn[15].

The basic principle of antibiotic selection will need to consider several factors. Suppose the infection is a bacterial infection characterized by significant and severe symptoms, more severe disease complications, and a condition that the immune system cannot overcome. In that case, it will be based on first-line and spectrum[16]. In addition, the selection of antibiotics is also seen from the resistance and susceptibility of pathogens that cause infection, pharmacological profile of antibiotic toxicity, absorption, binding, distribution, levels of drug concentration in blood and urine, previous experience with the same disease, and pathological conditions of the patient[17].

Essentially, the appropriate antibiotic administration is seen from the use of first-line or narrow-spectrum antibiotics because antibiotics will be more effective with the sensitivity of germs to the cause of infection so that it will reduce the risk of bacterial resistance[18]. The five most frequently used antibiotics used in this study were cefotaxime and ceftriaxone, which are third-generation of cephalosporin antibiotics. This antibiotic activity is less active against gram-positive cocci than in generation I, but it is more active against Enterobacteriaceae and includes beta-lactamase-producing strains. Furthermore, meropenem antibiotics from the carbapenem group have a more comprehensive range of activity than other beta-lactams. The spectrum of activity of carbapenems is to inhibit most gram-positive, gram-negative, and aerobes because they are highly resistant to beta-lactamases. Amikacin is an aminoglycoside antibiotic that inhibits gram-negative aerobic bacteria. This antibiotic has a narrow therapeutic index with severe kidney and hearing toxicity, especially in pediatric and elderly patients[19].

CONCLUSION

The antibiotic prescribing pattern in patients suffering from type diabetes mellitus II with infection includes different groups, with the highest percentage of the cephalosporin group. Moreover, diabetes mellitus patients with complications mostly have non-infectious comorbidities.

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