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Microbial Pattern of Diabetic Foot Ulcer Patient in Jemursari Islamic Hospital Surabaya Period 2012–2016

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Abstract

Diabetic foot ulcers (DFU) are complications in people with diabetes mellitus (DM) in the form of wounds or tissue damage resulting in vascular insufficiency and or neuropathy that can develop into an infection. Early detection of germs of diabetic foot ulcers may be used as a recommendation of empirical therapy before the definitive treatment based on culture results and appropriate antibiotics treatment, which may reduce hospitalization time and amputation events. According to Riskesdas in 2013, state that the number of antibiotic used without prescriptions in Indonesia about 86.1%. The study aims to retrospectively analyze the bacterial culture and drug susceptibility test results for patients with diabetic foot ulcers (DFU) in Jemursari Islamic Hospital Surabaya during 2012–2016 to help clinicians choose a more appropriate empirical antibiotic treatment for DFU. This study used cross–sectional designed with retrospective approaches, which analyzed descriptively and samples were taken by the total sampling of 11 samples. This research was conducted at Islamic Hospital of Jemursari Surabaya in May–September 2017 by using medical record data which are outpatient and inpatients who treatment at Jemursari Islamic Hospital. The result was found 6 types of bacteria consisting of *Staphylococcus aureus* (18%), *Staphylococcus non–haemolytic* (18%), *Klebsiella pneumonia* (27%), *Enterobacter aerogenes* (18%), *Burkholderia cepacia* (9%), *Escheria coli* (9%). The most sensitive antibiotics in the Gram–positive bacteria in this study are Amikacin, Teicoplanin and Oxacillin and the most resistant to Amoxicillin and Ampicillin whereas the most sensitive antibiotics in the Gram–negative bacteria in this study were Meropenem and the most resistant to Ciprofloxacin and Trimethroprim–sulfamethoxazole.

Keywords

Microbial pattern, antibiotics sensitivity pattern, diabetic, foot ulcer, diabetes mellitus

INTRODUCTION

Diabetes Mellitus (DM) is one of the main problems in public health system that has increased dramatically over the past 2 decades and continues to increase (1–3). Based on research by the World Health Organization (WHO) in developing countries showing the highest increase in DM patients in Southeast Asia including Indonesia and it is estimated that in the next 1 or 2 decades the frequency of DM in Indonesia will increase dramatically to rank number 5 in the world (4). Diabetes mellitus that is not treated properly will cause complications, as is the most common and often occurs is diabetic foot ulcer (DFU). Damage will arise if in the long term there is a decrease in blood flow accompanied by nerve damage (neuropathy) in the legs, thereby increasing the likelihood of DFU.

Diabetic foot ulcer is a wound that occurs in the legs of people with type 1 diabetes and 2, then infection and or tissue damage resulting from neuropathy (nerve disorders), angiopathy (impaired blood flow in the legs) or both that often become the place of entry of bacteria into the legs (5–6). Gardner (7) states that around 15% of patients suffering from DM will develop into DFU during their lifetime (7). Further infections without good treatment and adequate can be the most common cause of amputation, and based on non–traumatic events with the risk of amputation 10–20 times more often in patients with DM compared with non–DM (8), and about 85% amputation in DM patients associated with DFU (9), can even end in disability or death (10). The current DFU prevalence in Indonesia is 12%, while the prevalence of DFU risk factors in Indonesia is 55.4% (11).

Several studies show that there are variations in the types of germs that cause DFU, both aerobic and anaerobic germs. Akbar et al. (29) in Arifin Achmad Hospital for 23 samples received *A. baumanii* (34.8%), *K. pneumoniae* (26.2%), *E. coli* (17.4%), *E. cloacae* (8.7%), *P. stuartii* (4.3%), *R. ornithinolytica* (4.3%), and *P. aeruginosa* (4.3%). Research by Akhi et al. (2015) of 60 samples obtained *S. aureus* (28%), *Enterobacteriaceae* (24%), *E. coli* (15%), *Citrobacter spp*. (4%), *Enterobacter spp*. (4%), and *Staphylococcus spp*. negative coagulase (17%), *Enterococcus spp*. (15%), *P. aeruginosa* (7%), *Acinetobacter spp*. (4%), and *Bacteroides fragilis* (4%).

Data from previous studies show that early detection of germs in DFU can be used as a recommendation for empirical therapy before definitive therapy based on the results of culture and appropriate antibiotics, so as to reduce the time of hospitalization and the incidence of amputation. The results of Riskesdas in 2013 also stated that the use of prescription antibiotics in Indonesia was 86.1%. This study aims to retrospectively analyze the bacterial culture and drug

susceptibility test results for patients with diabetic foot ulcers (DFU) in Jemursari Islamic Hospital Surabaya during 2012–2016 to help clinicians choose a more appropriate empirical antibiotic treatment for DFU.

MATERIALS AND METHODS

The data collected are secondary data based on research variables taken from the Clinical Pathology Laboratory Installation of Jemursari Surabaya Islamic Hospital for the 2012–2016 periods. The population in this study was medical records of patients with diabetes mellitus with complications of diabetic foot ulcers at Jemursari Islamic Hospital Surabaya in January 2012–December 2016. The samples in this study were medical records of patients with diabetes mellitus with complications of diabetic foot ulcers in January 2012–December 2016, which fulfills the inclusion and exclusion criteria, and samples are taken in total sampling. The inclusion criteria in this study were medical records of DM patients with DFU who are hospitalized at Jemursari Hospital with complete identity, results of pus culture test, and antibiotic sensitivity test and exclusion criteria were grade 0 and grade 1 ulcers.

This research was carried out descriptively because the observations were carried out according to the conditions as they were without any direct treatment from the researchers on the test subjects and using a cross–sectional design with a retrospective approach. Evaluate the results of medical records regarding germs that cause DFU and the rational use of antibiotics in these cases.

RESULTS

DFU patients who were hospitalized at Jemursari Hospital from 2012 to 2016 totaled 291 patients. Data on DFU patients were then compared with data on patients who underwent pus culture at Jemursari Hospital. The data of the patients taken were 57 data on DFU patients with a history of undergoing a specimens culture of pus at Jemursari Hospital. The inclusion criteria in this study were medical records of DM patients with DFU who were hospitalized at Jemursari Hospital with a complete identity, results of pus culture test, and antibiotic sensitivity test. Based on the inclusion criteria of this study, 46 patient data were excluded from the study because there were no forms of pus culture test results and antibiotic sensitivity tests from the laboratory, so that the samples used in this study were 11 patients.

Distribution of DFU patients according age and sex

Table 1 showed that the results are differentiated by age group (16), with the age group 1–12 years and 12–18 years there are no DFU patients, in the age group 18–60 years, 195 patients (67.01%), and at age> 60 years there were 96 patients (32.99%), with an average age of 55.55 years. In this study,

there were 152 male patients (52.23%), while 139 female patients (47.77%).

Table 1. Distibution of DFU patients according age and sex

	Patient	Freq.	Percentage (%)
Age	1–12 years old	0	0
	> 12–18 years old	0	0
	> 18–60 years old	195	67.01
	>60 years old	96	32.99
Sex	Man	152	52.23
	Woman	139	47.77

Distribution of pathogenic germs to pus specimens

The results of germ culture from pus specimens in DFU patients at Jemursari Hospital showed in Figure 1. It showed that the 11 germ samples obtained two types of germs, namely Gram–positive and Gram–negative germs. The Gram–positive germs found in this study were *Staphylococcus non-haemolyticus* and *Staphylococcus aureus*, while the Gram–negative germs found in this study were *Escherichia coli*, *Enterobacter aerogenes*, *Burkholderia cepacia*, and *Klebsiella pneumonia*.

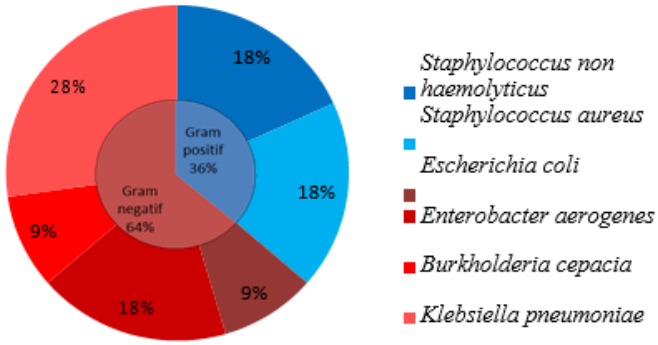

Fig 1. Distribution of pathogenic germs to pus specimens

The sensitivity pattern of Gram–positive germs to some antibiotics

The most sensitive antibiotics used in Gram–positive germs in this study were Amikacin, Teicoplanin, and Oxacilin, while the antibiotics most resistant to Gram–positive germs were Amoxycilin and Ampicillin.

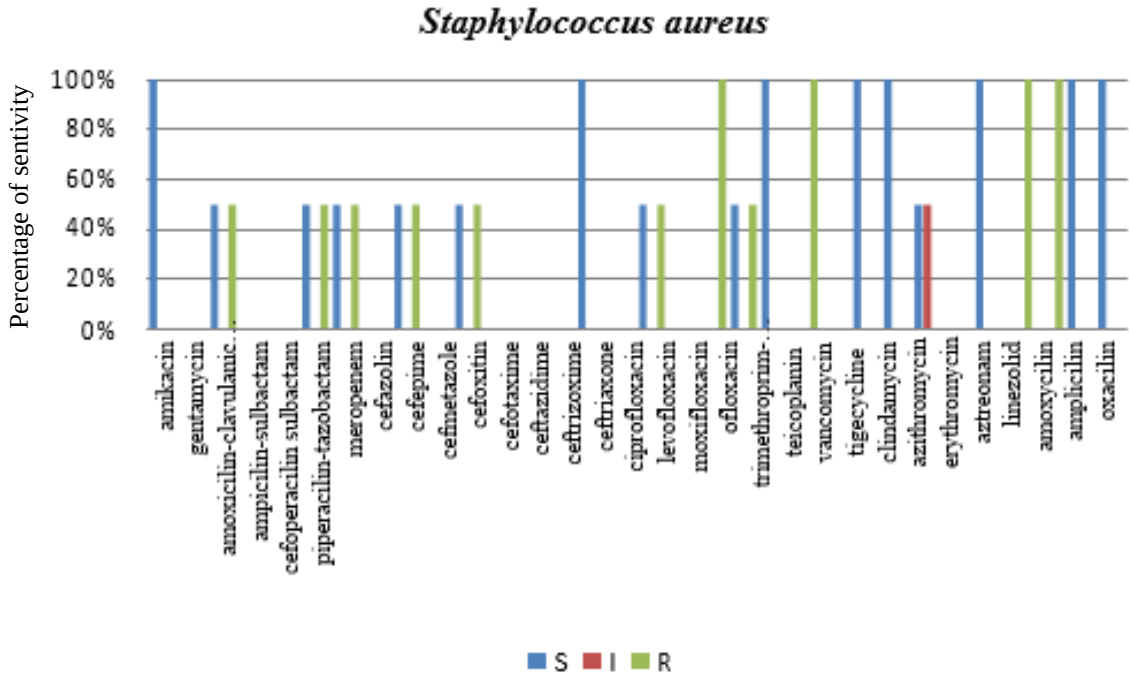

Fig 2. The sensitivity pattern of Gram–positive germs to some antibiosis

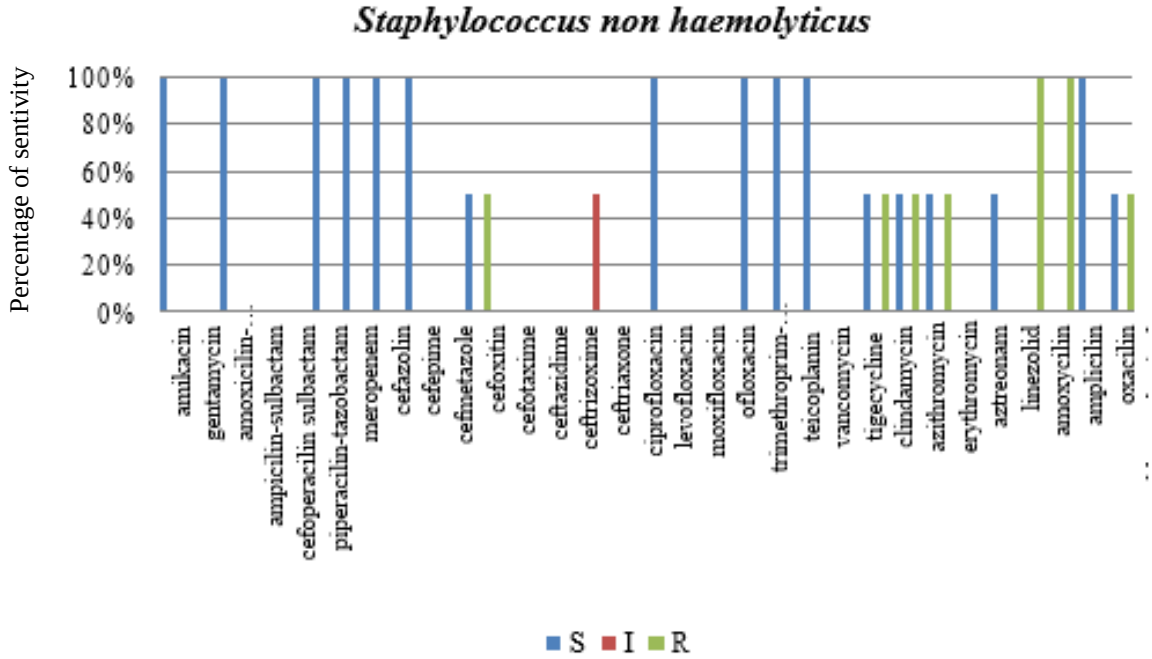

Fig 3. The sensitivity pattern of non haemolytic Staphylococcus antibiotics

The sensitivity pattern of Gram–negative germs to some antibiotics

The most sensitive antibiotic used in Gram–negative bacteria in this study is Meropenem, while the antibiotic most resistant to Gram–negative germs is Ciprofloxacin and Trimethroprim–sulfamethoxazole.

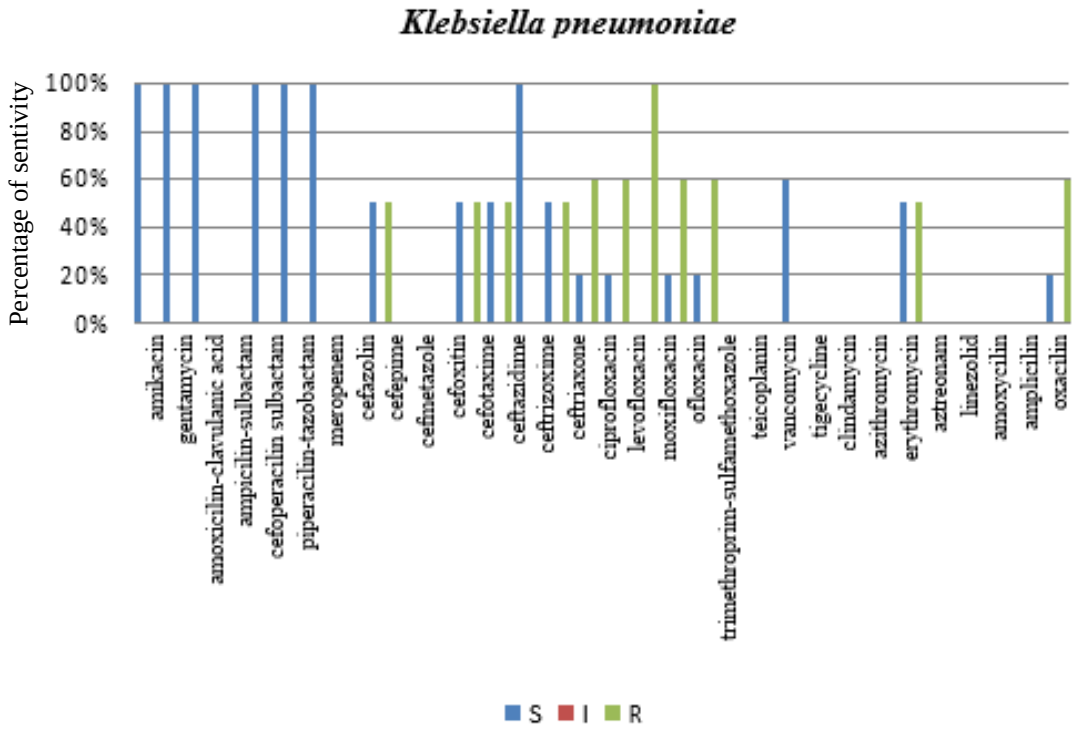

Fig 4. The sensitivity pattern of the antibiotic *Klebsiella pneumonia*

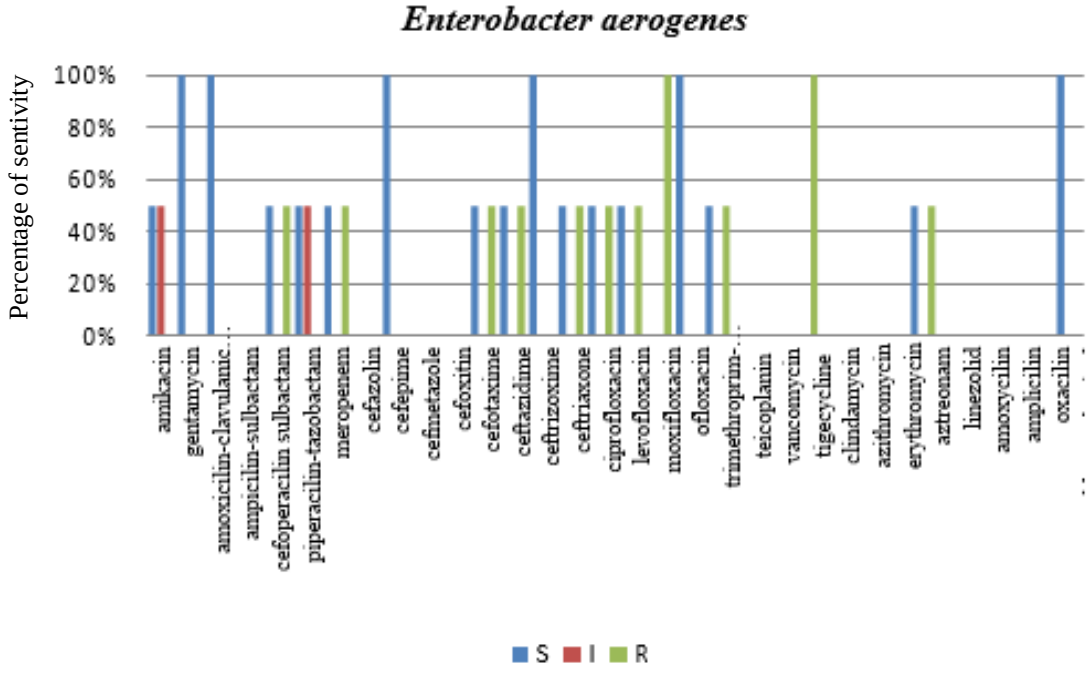

Fig 5. The sensitivity pattern of the antibiotic *Enterobacter aerogenes*

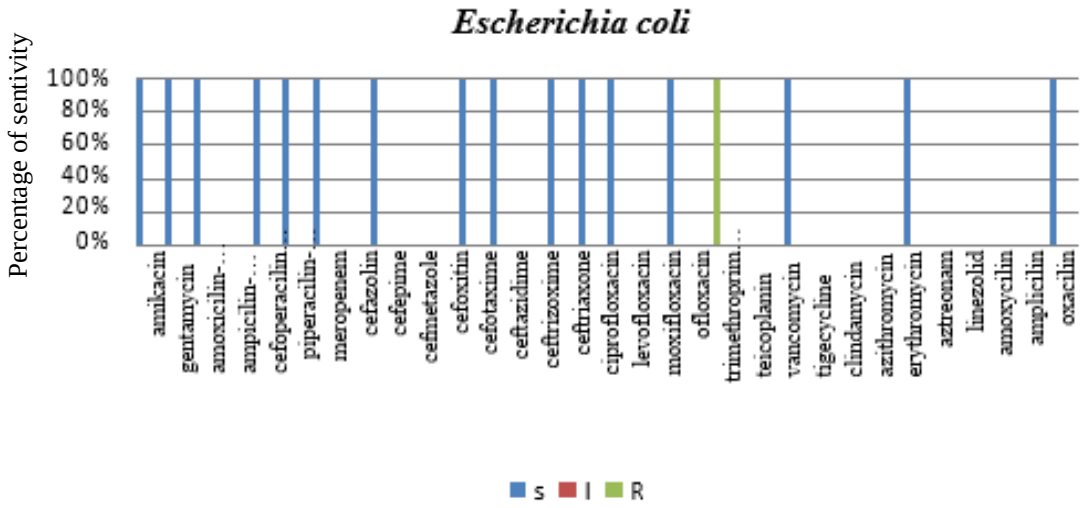

Fig 6. The sensitivity pattern of *Escherichia coli* antibiotics

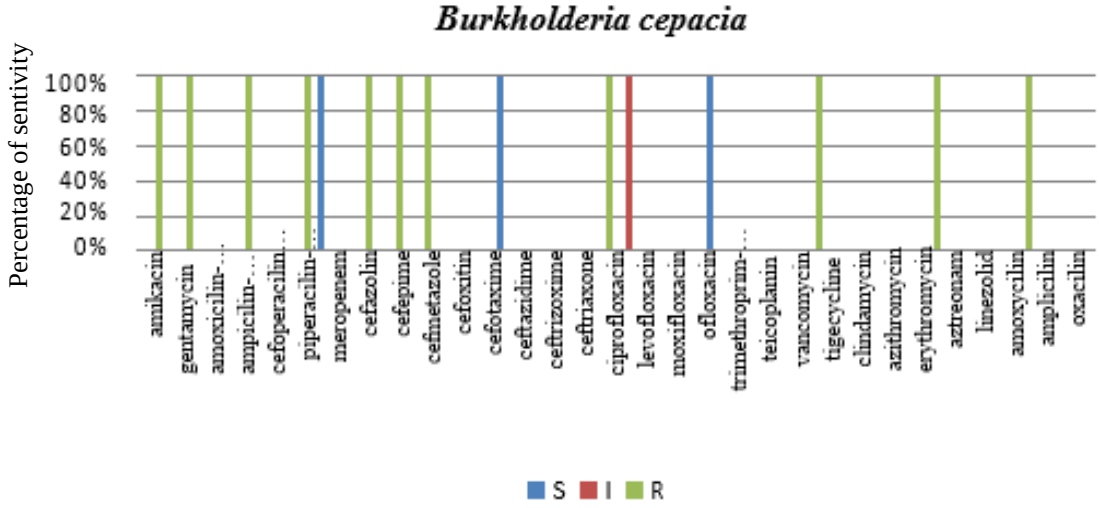

Fig 7. The pattern of antibiotic sensitivity of *Burkholderia cepacia*

DISCUSSION

Distribution of DFU patients according age and sex

The distribution of the age groups of patients with the most DFU in this study was 18–60 years as many as 195 (67.01%) with an average age of 55.55 years. Old age is one of the factors that influence DM, which can cause neuropathy complications in patients with DFU (12). The results of this study are in accordance with Decroli's research in RSUP dr. M Djamil Padang in 2007, which obtained the highest age group, was 40–59 years as many 65.8% (13–14). The age of patients suffering from diabetes and age at complications (one of them is diabetic ulcers) is related, this is in accordance with Tarigan's study at Herna Hospital in Medan in 2009–2010 where the highest DM patients in the age group >40 years as DM age groups the most is 128 (95.5%) (15).

Based on these studies it can be concluded that the age group with the most DFU is in the productive age group to old age. This could be attributed to people's lifestyles and eating patterns, especially those that are not good (16). Based on the results of the Basic Health Research (Riskesdas) in 2007, it was found that the proportion of deaths due to diabetes mellitus in the 45–54 year age group in urban areas was ranked second, namely 14.7% and national prevalence of DM based on examination of population gaet >15 years in urban areas is 5.7%. This illustrates that DM disease, especially in urban areas are serious and impactful problem productive age group productivity (17). Diabetic ulcer often occurs at the age of >50 years due to decreased physiological body functions such as decreased insulin secretion or resistance, so that the ability of the body to function on high blood glucose control is less optimal. Uncontrolled blood sugar levels will result in long chronic complications, both macro– and micro vascular, one of which is diabetic ulcer (18).

Factors that influence DM complications and are related to DFU other than age are gender. In this study, it was found that DFU patients in Jemursari Hospital were more prevalent in men (52.23%) than women (47.77%). This study is in line with the research of Decroli (2008) who obtained a sex distribution that was more dominant in men (71%) in RSUP Dr. M. Djamil Padang, and in accordance with the Gaol study (19), which gets the sex distribution more dominant in men (54%) in Dr. RSUP M. Djamil Padang in 2011–2013 (19). This study was also in accordance with Commons research at the Royal Darwin Hospital in 2015 with data on 177 patients found to be predominantly male (60%) (20). The research conducted by Danmusa (21) explained that the incidence of DFU was more prevalent in men (67.2%) compared to women (32.8%). This study also According to Chomi et al. (22) Diabetic ulcer distribution in men can be caused by men compared with women who consult doctors less often, and information given to doctors tends to be less (22). The research conducted by Danmusa (21) explained that the incidence of DFU was more prevalent in men (67.2%) compared to women (32.8%). Jobs for men spend more time outdoors and do more work severe, making it easier for DFU to occur and increasing the risk of amputation. Amputation in male DM patients has twice the risk (22–23).

This research is not in line with Fahmi's (24) research in Cengkareng Regional General Hospital in 2013–2014 where women were dominant (57.6%), and Witanto's research at Immanuel Hospital in Bandung, which had more dominant female distribution (63%) (24–25).

The difference in research between the two groups can be overcome if this research is conducted with more and more representative sample sizes.

Distribution of Gram–positive and Gram–negative germs

Based on this study and other studies it can be seen that germs found in DFU patients at different places and at different times not exactly the same, but some of the same germs like *S. aureus, K. pneumoniae, E. coli* and *Enterobacter* are obtained. The Gram–positive germs that were present in the DFU in this study were *S. aureus* (18%) and *non haemolytic Staphylococcus* (18%). Gram–negative germs present in DFU in this study were *K. pneumoniae* (27%), *E. aerogenes* (18%), *B. cepacia* (9%), *E. coli* (9%). In this study, it was found that infection in DFU was still caused by a polymicrobial infection so that the pattern of diabetic foot infection specifically could not be ascertained. Each study has different characteristics of germ patterns depending on the patient's condition and environment so different empirical antibiotic therapies are needed as well (26)

The sensitivity pattern of Gram–positive germs to some antibiotics

S. aureus was found to be 100% sensitive to antibiotics Amikacin, Ceftriaxone, Teicoplanin, Clindamycin, Azithromycin, Linezolid, Oxacilin, and Chloramphenicol, 50% sensitive to Amoxicilin–clavulanic acid, Piperacillin–tazobactam, Meropenem, Cefepime, Cefoxitin, Levofloxacin, Trimethroprim–sulfamethoxazole, and Erythromycin. *S. aureus* was found to be 100% resistant to Ofloxacin, Vancomycin, Amoxycilin, and Ampicillin, 50% resistant to Amoxicilin–clavulanic acid, Piperacillin–tazobactam, Meropenem, Cefepime, Cefoxitin, Levofloxacin, and Trimethroprim–sulfamethoxazole.

Infection patients who are given penicillin as the first therapy and their incomplete administration can cause resistance since the emergence of methicillin–resistant *S. aureus*, vancomycin glycopeptide is the only uniformly effective treatment for Staphylococcus infection. Resistance of vancomycin glycopeptide to *S. aureus* (27). This study is in accordance with the research of Chaudhry et al. (28) who received Staphylococcus aureus were resistant to Penicillin (100%), Vancomycin (80%), and Ampicillin (30%) (28).

The sensitivity pattern of Gram–negative germs to some antibiotics

K. pneumoniae was found to be most sensitive to Amikacin, Gentamycin, Amoxicilin–clavulanic acid, Cefoperacilin sulbactam, Piperacilin–tazobactam, Meropenem, and Ceftrizoxime. *K. pneumonia* was found to be 100% resistant to the antibiotic moxifloxacin fluoroquinolone, resistant 66.67% of Ciprofloxacin, Levofloxacin, Ofloxacin, Trimethroprim–sulfamethoxazole, and Chloramphenicol,

while 50% were resistant to Cefepime, Cefotaxime, Ceftazidime, Ceftriaxone, and Aztreonam.

Akbar et al. (29) obtained *K. pneumonia* sensitive to Amikacin antibiotics (100%) (29). This study is in accordance with the research of Chaudhry et al. (28) who received *K. pneumonia* resistant to Ceftazidime (100%), Ceftriaxone (100%), Cefepime (100%), Cefotaxime (80%), Aztreonam (60%), and Chloramphenicol (20%) (28).

CONCLUSIONS

In this research, it can be concluded that the age group of patients with the most DFU is the age group 18–60 years as many as 195 (67.01%) patients, with an average age of 55.55 years. Based on gender, the majority of DFU patients were men (152.23%). The germs found in this study were *S. aureus* (18%), *non–haemolytic Staphylococcus* (18%), *K. pneumoniae* (27%), *E. aerogenes* (18%), *B. cepacia* (9%), *E. coli* (9%) The dominant germ found in diabetic foot ulcer patients at Jemursari HospitalI period 2012–2015 is a Gram–negative germ, namely *K. pneumonia* (27%). The sensitivity of antibiotics to germs consist of the most sensitive antibiotics in Gram–positive germs in this study were Amikacin (100%), Teicoplanin (100%), and Oxacillin (100%), and the most resistant to Amoxicillin (0%) and Ampicillin (0%). The most sensitive antibiotic used in Gram–negative germs in this study is Meropenem (100%), while the antibiotic most resistant to Gram–negative germs is Ciprofloxacin (0%) and Trimethroprim–sulfamethoxazole (0%).

CONFLICT OF INTEREST

There are no conflicts of interest.

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