



## Original Article

## Antibiotic therapy for diabetic foot infections in a tertiary care hospital in Jakarta, Indonesia

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## ABSTRACT

**Aims:** The purpose of this study was to determine the microbiology of diabetic foot infections and to assess the antibiotic susceptibility patterns.

**Materials and methods:** A cross sectional retrospective study of 35 patients with diabetic foot infections hospitalized at the internal medicine clinic of Dr. Mintohardjo Navy Hospital, Jakarta. The data were collected from patient medical records retrospectively. The classification of the diabetic foot infections was evaluated according to Meggit–Wagner's Classification. Identification of causative microorganisms was performed by standard microbiologic methods. Antibiotic susceptibility testing was performed using disk-diffusion method.

**Results:** During January to December 2012, a total of 288 of diabetic patients were admitted to hospital, and 35 patients had diabetic foot infections. According to Meggit–Wagner's classification the most common disease was grade 3 in 31.4% patients, followed by grade 2 in 25.7%, and grade 4 in 17.3% of patients. Conservative diabetic control care was carried out in 37.1% of patients, and surgical intervention was carried out in 62.9% of patients. A total of 59 pathogens were identified. The most common infecting microorganism isolated on pus cultures was *Staphylococcus aureus* (47.5%), followed by *Pseudomonas* spp (16.9%), *E. coli* (10.2%), *Streptococcus* spp. (8.5%), *Enterobacter* spp. (7.0%), *Proteus* spp. (6.7%), and *Acinetobacter* spp. (3.2%). Overall, 37.2% of the diabetic foot infection caused by a single microorganism, and 62.8% had polymicrobial infections. The most frequently administered antibiotic was ceftriaxone (40.0%), followed by ciprofloxacin (11.4%), and meropenem (8.6%).

**Conclusion:** Diabetic foot infections (62.8%) were polymicrobial. *S. aureus* was most commonly found in the foot infection. Most of the microorganisms isolated from diabetic foot infection were resistant to many types of antibiotics.

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### 1. Introduction

Diabetes mellitus is a serious and complex illness that affects almost all the vital organs in the body. Approximately 382 million people worldwide suffer from diabetes and it has been estimated that it will increase to 592 million by 2035. In 2013, diabetes caused more than 5.1 million deaths, where every 6 s a person dies from diabetes [1]. The disease is known to have many complications and one of the most severe is diabetic foot infection that affects 15% of people with diabetes, and leading to amputation [2]. Every year, more than one million diabetes patients require limb amputation [3].

Indonesia is the seventh largest country in the case of diabetes mellitus incidence in the world after China, India, USA, Brazil, Russia and Mexico. The incidence of diabetes mellitus in Indonesia is estimated at about 8.5 million in 2013 [1].

For the treatment of diabetes mellitus, the Infectious Diseases Society of America (IDSA) has recommended a guideline that the treatment of diabetic foot infection should be performed by a team of multidisciplinary diabetic foot care consisting of an infectious disease specialist, specialist of clinical microbiology, foot surgeons, and wound-care specialists [4].

Diabetic foot infections are often caused by a number of infecting microorganisms. *Staphylococcus aureus*, *Streptococcus pyogenes*, *Staphylococcus epidermidis*, *E. coli*, *Pseudomonas aeruginosa*, *Klebsiella pneumoniae*, *Acinetobacter* spp, *Proteus* spp., and *Enterococcus* spp. are some of the frequent pathogens contribute to progressive tissue damage [4–7]. The presence of obligate anaerobes associated with

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necrosis, gangrene, or ischemic tissue and usually occurs in severe chronic infections [4,8,9]. Diabetic foot infections caused by bacteria such as multi-drug-resistant methicillin-resistant *S. aureus* usually occurs in patients who are admitted to the hospital and in the community with a high prevalence of drug resistance [4,8,9].

The increasing of diabetic foot infections caused by multidrug-resistant pathogen is responsible for the duration of hospitalization, morbidity and mortality of diabetic patients [6].

The optimal treatment of diabetic foot infection is still a matter of concern. This diabetic complication is very difficult to treat if proper protocol is not followed [10–12]. However, most researchers agree that the management of this infection requires isolation and identification of microbial flora, appropriate antibiotic therapy according to the local sensitivity pattern, proper selection and identification of chronic complications and appropriate surgical intervention for this complication [7].

Educating diabetic patients is one of another way in preventing diabetic foot infections and to improve the outcomes of therapy. Empirical broad-spectrum antibiotic regimens can be administered. However, the sensitivity tests of bacterial pathogens should be performed to assist in the selection of appropriate antibiotic treatment regimens [13]. Narrow-spectrum antibiotics can be selected for acute or less severe infection, while the broad-spectrum antibiotics should be used in cases of chronic or severe infection [14]. The appropriate diabetic foot infections care could prevent more than 40% of amputations [15].

In Indonesia, there has been a limited study of the diabetic foot infections care, especially the control of infection by appropriate antibiotics. Therefore, the purpose of this study was to evaluate the antibiotic treatment for diabetic foot infection in Dr. Mintohardjo Navy Hospital, Jakarta Indonesia.

## 2. Patients and methods

A retrospective cross-sectional study was carried out at tertiary care Navy Hospital of Dr Mintohardjo, Jakarta, Indonesia. Demographic and clinical data were collected retrospectively from patient medical records who had admitted to hospital during January to December 2012. The inclusion criteria were inpatients that hospitalized at internal medicine clinic, suffered diabetic foot infection. Out patients and patients with incomplete information of medical records were excluded from the study. The classification of the diabetic foot infections were evaluated according to Meggit–Wagner's Classification [16,17].

### 2.1. Isolation of bacteria and antibiotic susceptibility test

All foot ulcer samples were collected aseptically and were plated right after the collection. Identification of causative microorganisms was performed by standard microbiologic methods. Antibiotic susceptibility testing was performed using disk-diffusion method. The results were interpreted according to the guidelines of the Clinical and Laboratory Standards Institute [18].

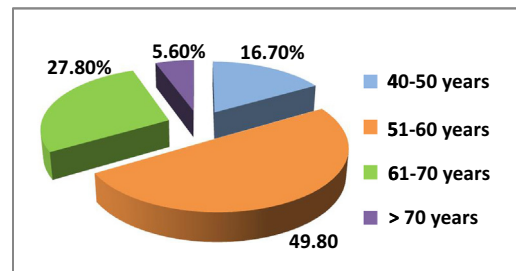


Fig. 1. The age range of diabetic foot patients.

## 3. Results

During January to December 2012, a total of 288 of diabetic patients were admitted to hospital, of which 35 diabetic foot infection patients were hospitalized and have been considered as qualified for inclusion criteria. We found that diabetic foot infection affected males slightly more frequent (54.3%) as compared to females (45.7%); the male to female ratio was 1.18:1. The age ranged of diabetic foot patients was from 46 to 75 years, and the most common age groups of diabetic foot patients was the age group of 51–60 years, followed by the 61–70 years age group as shown in Fig. 1. The grade of diabetic foot infection according to Meggit–Wagner's classification is shown in Table 1. The commonest disease was grade 3 that comprised of 31.4% patients, followed by grade 2 in 25.7%, and grade 4 in 17.3% of patients. Conservative diabetic control care was carried out in 37.1% patients and surgical intervention was carried out in 62.9% of patients. We found that the most of the diabetic foot patients were hospitalized for 6–10 days as shown in Fig. 2.

A total of 59 pathogens were identified with an average of 1.68 microorganisms per patient. The most common infecting microorganism isolated on pus cultures was *S. aureus* (47.5%), followed by *Pseudomonas* spp (16.9%), *E. coli* (10.2%), *Streptococcus* spp. (8.5%), *Enterobacter* spp. (7.0%), *Proteus* spp. (6.7%), and *Acinetobacter* spp. (3.2%). Overall, 37.2% of the cultures were a single microorganism, and 62.8% had mixed infections.

The results of sensitivity patterns of the isolated microorganisms are shown in Table 2.

## 4. Discussion

Diabetes mellitus is a global health problem which diabetic foot infection is one of the most serious complications [19]. This complication is more common in the older age group compared with younger ones. In our study we found that the most commonly affected age group was between 50 and 60 years. This result was similar to previous studies that diabetic foot infections often occur in patients older than 50 years [7,10,20].

Various studies show that diabetic foot infection has the longest hospital stay as compared to other complications of diabetes

Table 1  
The grade frequency of diabetic foot infection according to the Meggit–Wagner's Classification of Diabetic Foot infections.

Grade	Disease	Treatment management	Frequency (%)
0	No ulcer in a risk foot	Prevention	0
1	Superficial ulcer	Antibiotics, glycemic control, and local wound care	11.4
2	Deep ulcer, involve ligaments and muscles, but no bone involvement	Antibiotics and glycemic control, adequate perfusion, local wound care and regular debridement	25.7
3	Deep ulcer with bone involvement often with osteomyelitis	Antibiotics and glycemic control, debridements, and off-loading of the foot	31.4
4	Localized gangrene	Extensive debridement with or without amputation	17.3
5	Extensive gangrene of the whole foot	Amputation	14.2

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