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Original Article

PEDIS Classification in Diabetic Foot Ulcers Patients

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Introduction: Diabetic foot ulcer are one of several serious complications of diabetes progression. Up to 15% of patients with diabetes have diabetic foot ulcer and these ulcers lead to more than 80,000 amputations per year in the United States. Many DFU classification systems have been proposed to predict clinical outcome; however, almost of these systems have limitations. To categorize and define DFU objectively, the International Working Group of the Diabetic Foot (IWGDF) developed the PEDIS classification system. These collective findings and because of there is no findings of characteristic of DFU based on PEDIS classification in Mohammad Hoesin Hospital indicate that this research is needed to do.

Method: This is a prospective study at Mohammad Hoesin hospital, Palembang. The aim is to describe the characteristic of diabetic foot ulcers based on PEDIS classification. There were 41 cases evaluated under this study.

Results: Peripheral arterial disease is the most problem in perfusion. 1-3 cm2 is the most happen in extent. Wound depth on fascia or muscle or tendon is the most happen. Abscess or fascitis is the most problem in infection. Loss of sensation is the most happen. PEDIS score ≥ 7 is the most happen.

Conclusion: Early prevention and treatment from vascular and endovascular surgery can be considered as the most important for the management of diabetic foot ulcers patient.

Keywords: Diabetic Foot Ulcer, PEDIS classification, Peripheral Arterial Disease
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INTRODUCTION

Diabetic Foot Ulcer (DFU) is one of the few serious complications of diabetes mellitus. The main causes of DFU are peripheral neuropathy and peripheral arterial disease.[1-3]. The number of DFU patient in the world was around 55 million people in 2011, and this number is expected to increase to 83 million by 2030.[4]. In Indonesia, DFU patient numbered 1.095 million in 2011, predicted to increase to 1,770 million in 2030.[4] Based on these data, the increase in the number of DM patient in Indonesia is higher (23.6%) than at the world level (20.26%).[4] The number of DFU patient is estimated to be around 15% of the number of people with diabetes mellitus and causes more than 80,000 cases of amputations per year in the United States[5,6] As a result of the development of DFU, the risk of amputation in patients has also increased, almost 84% of patient of lower limb amputations due to diabetes mellitus.[7] Estimation of the annual cost expenditures due to DFU treatment in patients with diabetes mellitus is 10.91 million US dollars.[8] Foot ulcers significantly contribute on the morbidity and mortality of patients with diabetes mellitus. Diabetic patients with foot ulcers require long-term hospitalization.[9] From these findings, it indicates that DFU can cause serious disabilities, decrease quality of life, and incur significant costs.[10]

There are many DFU classifications that have been used to predict clinical manifestation; However, almost all of these systems have limitations. First, most classification systems only focus on local pathology of DFU and cannot adequately assess all important parameters related to ulcer healing. For example, the Wagner system specifically assesses the depth of ulcers without comorbidities such as ischemia and neuropathy.[11] Second, some classification systems do not standardize the definition of ischemia, infection and systemic variables important for wound healing. Finally, some DFU classification systems have been validated, and none of the classifications have received worldwide recognition.[12] To classify and determine DFU objectively and facilitate communication between health care providers, the International Working Group of the Diabetic Foot (IWGDF) developed a classification system Perfusion, Extent, Depth, Infection and Sensation (PEDIS), where DFU is classified according to five categories: perfusion, area / size, depth, infection and sensation. This category is considered to be able to explain the pathogenesis relevant in the development of DFU. In addition, each subcategory is defined according to criteria obtained

based on objective techniques that apply throughout the world.[12] The PEDIS classification system was developed primarily for research and has not been validated in clinical practice in terms of prognosis.[12]

Based on the fact, it is deemed necessary to conduct further research on the characteristics of patients with diabetic foot ulcers based on the PEDIS classification which has never been examined at RSUP Dr. Mohammad Hoesin and is expected to be used as a reference for medical personnel and related parties in taking action in order to improve health services more effectively.

METHOD

This type of research is a prospective study with a descriptive research design. Took place in January 2018 to March 2018. The population in this study were all patients with diabetic foot ulcers who came to the sub-division of vascular and endovascular surgery Dr. RSUP. Mohammad Hoesin Palembang from 1 January 2018 to 31 March 2018. The sample in this study was all populations that met the criteria inclusion.

The criteria inclusion of this study were all patients with diabetic foot ulcers and obtained all the variables studied in full, while the exclusion criteria of this study were patients with diabetic foot ulcers with other comorbidities.

Characteristics of patients with diabetic foot ulcers divided into gender, age, smoking habits, body mass index, duration of diabetes, hypertension, kidney failure, osteomyelitis, LDL values and PEDIS score are described descriptively and data are presented in tabular form and analyzed with the SPSS version program 21.

RESULTS

Based on gender, there were 20 male and 21 female. Based on age, the average age of patients with diabetic foot ulcer was 54.1 years with an age range of 30-79 years, the majority of patients with age ≥ 45 years were 18 patients (86%) and <45 years as many as 3 patients (14%). 17 patients were smoked, while the other 24 patients did not smoke.

The result of body mass index of diabetic foot ulcer patients is that there are no patients in the underweight category, 11 peoples in the normoweight category, 28 peoples in the overweight category, 2 peoples in the obesity category. 14 patients have diabetes mellitus less than 5 years and 27 peoples have diabetes mellitus for more than 5 years. 17 peoples have no history of hypertension, 7 peoples with pre hypertension, 11 peoples with first grade hypertension, 6 peoples with second grade hypertension. There are 20 peoples without chronic kidney failure, 2 peoples with first grade kidney failure, 4 peoples with second grade kidney failure, 8 peoples with third grade kidney failure, 4 peoples with fourth grade kidney failure, 3 peoples with fifth grade kidney failure. The results of X-ray pedis examination showed that 16 peoples were diagnosed with osteomyelitis and 25 peoples were diagnosed with no osteomyelitis. LDL examination results obtained 26 peoples with LDL results ≤ 100 and 15 peoples with LDL results >100.

In this study, perfusion examination showed that 6 peoples did not suffer from PAD, 23 peoples suffered from PAD, 12 peoples suffered from CLI, from the results of examination of the extent obtained results of 1 peoples with skin contact, 4 peoples with injuries less than $1cm^2$, 19 peoples with injuries $1cm^2$ to $3cm^2$, 17 peoples with more than $3cm^2$, from depth examination found that there were no people with skin intact wound depths, 8 peoples with superficial wound depths, 24 peoples with deep fascia or muscle or tendon depths, 9 peoples with bone depths or joints, from examination of infection obtained results of 2 peoples not infected, 17 peoples with infection on the wound surface, 19 peoples with abscess infections, 3 peoples with SIRS infection, from sensation examination results obtained 9 peoples with still has sensation, 32 people with loss of sensation.

Table 1. General Characteristics Of Research Subjects (n=41)

Characteristics		**N**	**%**
Gender	Male	20	49
	Female	21	51
Age	≥ 45 years old	38	92
	< 45 years old	3	8
Smoking Habit	Yes	17	41
	No	24	59
Body Mass Index	Underweight	0	0
	Normoweight	11	27
	Overweight	28	68
	Obesity	2	5
Duration of diabetes	≤ 5 years old	14	34
	> 5 years old	27	66
Hypertension	No	17	41
	Pre Hypertension	7	17
	First Grade Hypertension	11	27
	Second Grade Hypertension	6	15
Chronic Renal Failure	No	20	49
	First Grade	2	5
	Second Grade	4	10
	Third Grade	8	20
	Fourth Grade	4	10
	Fifth Grade	3	6
Pedis X-Ray	No osteomyelitis	25	61
	Osteomyelitis	16	39
LDL values	≤ 100	26	63
	> 100	15	37

Table 2. Characteristics of PEDIS Classification Research Subjects (n=41)

Characteristics		N	%
Perfusion	No PAD	6	15
	PAD	23	56
	CLI	12	29
Extent	Skin intact	1	2
	< 1 cm^2	4	11
	1 cm^2–3 cm^2	19	46
	>3 cm^2	17	41
Depth	Skin intact	0	0
	Superficial	8	20
	Fascia, muscles, tendons	24	58
	Bones or joints	9	22
Infection	No infection	2	5
	Surface	17	41
	Abscess or fascitis	19	47
	SIRS	3	7
Sensation	Yes	9	22
	No	32	78

With a PEDIS score of more than 7, 28 were found, and a PEDIS score of less than 7 was obtained 13 peoples

DISCUSSION

The results of this study are not in accordance with the study of Fauci et al (2008) mentioning one of the risk factors that can cause foot ulcers and amputations is male.[13] Results of research conducted by Decroli et al in RSUP Dr. M. Djamil Padang also mentioned that diabetic foot ulcer patient were male more than female.[14] But according to the results of research conducted by Kahuripan et al in RSUD dr. H. Abdul Moeloek Lampung using a cross sectional method retrospectively from the medical record data of diabetic ulcer patients treated from January 1, 2005 to May 30, 2009 reported that diabetic foot ulcer patient suffered the most by women (65.3%).

In the United States alone, cases of diabetic foot ulcers who are older than 60 years have a greater percentage than age less than equal to 60 years. In line with the results of Utami's study which reported that patient of diabetic foot ulcers were mostly found in respondents aged 55-60 years.[15] According to the Agency for Healthcare Research and Quality (AHRQ) in 2008, diabetic foot ulcers were most commonly found in the 45-54 year age category.[16] According to Gupta et al, Decades 4 and 5 are the most common age group of diabetics with foot implications.[17]

The results of this study are not in accordance with Norwood (2011) which states that smoking history is one of the risk factors causing diabetic foot ulcer.[18] The results of this study are also not in accordance with Baker et al (2005), patients with diabetes mellitus who have a history or risk of smoking 10 -16 times greater occurrence of peripheral arterial disease. Blockage of blood vessels results in a decrease in the amount of blood circulation in the legs and decreases the amount of oxygen sent to the tissues and causes ischemia and ulceration or diabetic foot ulcers.[19]

The results of this study are consistent with research findings of Mariam et al., Which showed that diabetic patients who were overweight were 2.1 times more at risk of developing diabetic foot ulcers compared to those who were of normal weight [AOR = 2.1; 95% CI: 1.15, 3.10] .[20] This is consistent with research conducted in Ethiopia, Kenya and Nigeria.[21-23] Possible reasons for higher foot pressure in heavier bodies and with diabetic patients with a higher body mass index (BMI) as well as obesity and being overweight can intensively decrease the normal blood circulation patterns in the lower extremities; As a result, this can cause diabetic foot ulcers.

The results of this study are consistent with a study in India by Shahi in 2012 on 678 patients with diabetes melltius showing the results of long-standing diabetes mellitus ≥ 5 years is a risk factor for diabetic ulcers. The results of this study are in accordance with the research of Shahi et al., Who stated that diabetic foot ulcer patients were more common in patients with DM duration of ≥ 5 years.

The results of this study are not in accordance with the study of Chuan et al in 364 DFU patients showing the results of patients with hypertension there are 179 people and patients without hypertension there are 185 people.[24]

Hyperlipidemia in people with DM is one of the causes of endothelial dysfunction and increases oxygen free radical production which inactivates nitric oxide, so LDL-C will be buried in the intima layer where the endothelial permeability is increased.

The accumulation of LDL-C in the vascular wall in the intima layer coupled with chemical changes in fat triggered by free radicals in the arterial wall will produce oxidized LDL-C that plays a role and accelerates the emergence of atheromatous plaque.[25,26]

Growth factors and growth hormones stimulate the proliferation and migration of macrophages and vascular smooth muscle cells to form atherosclerotic plaques. The proliferation of smooth muscle cells and the deposition of extra cell matrix in the intima converts fatty patches to mature fibrofatty atheroma and contributes to the growth of atherosclerotic lesions and forms atherosclerotic plaque.[26,27]

This causes the process of macroangiopathy in blood vessels so that tissue circulation decreases marked by loss or reduction of the pulse in the dorsalis pedis, tibialis and poplitea arteries, feet become atrophy, cold and thickened nails.

Subsequent abnormalities occur in tissue necrosis, resulting in ulcers which usually begin at the tip of the foot or leg.

The results of this study are in accordance with the research of Rodrigues et al who identified risk factors for Lower Limb Amputation (LLB) in patients with diabetic foot ulcers, one of which is a history of osteomyelitis.[28] So osteomyelitis can be used as a consideration for determining the prognosis of diabetic foot ulcers.

The results of this study are not in accordance with the results of the study Chuan et al explain from the examination of perfusion of patients with diabetic foot ulcers who do not PAD is the most cases, followed by those experiencing PAD and CLI. The results of this study are in accordance with the results of the study Chuan et al. Explained that from examination of the extent obtained wound area 1cm^2-3cm^2 is the most cases, followed by wound area of more than 3cm^2, less than 1cm^2, skin contact. The results of this study are consistent with the results of the study by Chuan et al. Explaining that from depth examination it was found that the depth of the fascia or muscle or tendon wound was the most cases, followed by bone or joint, superficial, skin contact. The results of this study are not in accordance with the results of the study Chuan et al. explained that examination of infections found infection of the wound surface was the most cases, followed by abscess infection, SIRS infection, and did not experience infection. From the sensation examination the results of sufferers with lost sensation are the most cases, followed by those with sensation.[24]

The results of the study by Chuan et al. Explain the Extent Larger (OR, 2,461, 95% CI, 1,373-4,412, P = 0.002), Deeper wound (OR, 12,494, 95% CI, 4,076-38,297, P <0,001), Severe Infection (OR, 7,202, 95% CI, 3,407-15,224, P <0,001), and Loss Sensation (OR, 9,545, 95% CI, 3,184-28,611, P <0.001) have an effect on increasing the incidence of diabetic foot ulcer.[24]

Many diabetic foot ulcer scoring systems have been used with the aim of facilitating fast and accurate clinical decisions. Monteiro et al[29] used ROC curve analysis to assess the accuracy of different diagnostic systems for diagnostic diabetic foot ulcers and considered it the best method for measuring the diabetic foot ulcer scoring system.[30,31] In addition to ROC curve analysis, Monteiro et al also used AUC values to ensure the diagnostic accuracy of the system PEDIS score to predict the results of diabetic foot ulcers. The results of the Monteiro et al study showed that the PEDIS score system also has a very good ability to predict the results of diabetic foot ulcers. In addition, the research of Chuan et al. Showed that the value of the PEDIS category with a score of 7 or more was associated with a much greater likelihood of healing difficulties. Chuan et al explained that the PEDIS score system must be widely applied in clinical practice.[24]

CONCLUSION

PEDIS score system is a good predictor for the results of diabetic foot ulcers. Early prevention and treatment from vascular and endovascular surgery can be considered as the most important for the management of diabetic foot ulcers patient.

CONFLICT OF INTEREST

The author states the original work, and there is no conflict of interest in doing this research.

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