

An Appearance Characteristic Ulcer In Diabetic Patients At Kitamura Clinic In Pontianak, Indonesia

Suriadi, AWCS, CFCN, Ph.D

Abstract: Background: *There are several types of diabetic foot ulcers, namely neuropathic, ischemic, neuro-ischemic, mix ulcer, diabetic bullae, and furuncle/carbuncle. This study intends to identify the characteristics of ulcers in diabetic patients.*

Methods: *A cross-sectional study was conducted in Kitamura Wound Clinic, in Pontianak-Indonesia from October 2019 to February 2020 to investigate ulcer occurrence in diabetic patients. A sample was used to select 292 study participants. A univariate model analysed the characteristic respondent and ulcers.*

Results: *The median and range age of the participants was 56 (27-87) years, and 55.1% of the participants were female. The patients with positive neuropathy were 30.8%, the mean of systole blood pressure was 135.68 (± 23.9) and diastolic pressure was 83.02 (± 11.4). The median and range of HbA1C were 9.8 (6.44 -14). Characteristics of ulcer in diabetic included 36% DUDT (diabetic ulcer due to trauma), 37.3% diabetic bullae, 9.2% furuncle/carbuncle (boils), and 8.6% neuropathic. The most common cause of ulcers was trauma (47.9%) and the most common ulcer locations were 38.4% on the toe and plantar (24.7%).*

Conclusion: *This study found the characteristics of ulcers in diabetic patient were DUDT, neuropathic, ischemic, neuro-ischemic, arterial, venous, mixed ulcer, diabetic bullae and furuncle/carbuncle. Health care providers should distinguish the types or characteristics of ulcers in diabetic patients so that they can consider wound care and treatment according to the characteristics of diabetic ulcers.*

Keywords: *diabetic ulcer, DUDT, characteristic, neuropathic, arterial, ischemic, neuro-ischemic, furuncle, mix ulcer.*

1. INTRODUCTION

The burden of diabetes mellitus is increasing globally, especially in developing countries, including Indonesia. Indonesia is ranked seventh in cases of diabetes mellitus in the world [1]. Diabetic patients have a 25% lifetime risk of developing foot ulcers and a chronic ulcer [2]. Diabetic foot ulcers may develop because of peripheral arterial disease, pressure overload and/or high plantar pressure, poor foot care, trauma, neuropathy, and foot pathologies such as fissures and callosities [2,3].

There are several types of diabetic foot ulcers, namely neuropathic, with the presence of peripheral diabetic neuropathy, ischemic, if the patient has peripheral arterial disease and no diabetic peripheral neuropathy, and neuro-ischemic, in which the patient has neuropathy and ischemia [4]. Diabetic patients can also experience arterial ulcers, venous ulcers, furuncles/carbuncles (boils), mixed ulcers V/A (venous /arterial), and diabetic bullae [5-10]. Many studies have reported types of ischemic ulcers and neuropathy in diabetic patients. However, there is no study that describes other types of diabetic ulcers due to trauma

(DUDT) and/or other characteristics of diabetic patients. Trauma, in other words, is a wound that is caused by an external force, by accident, by choice (operation), by physical contact, by burning and/or types of radiation such as a thermal injury [11,12]. This study describes the characteristics of ulcers, including those due to trauma. There is no study that describes the ulcers that occur in diabetic patients. This study aims to identify the characteristics or types of ulcers that occur in diabetic patients.

2. METHOD

A cross-sectional design study was conducted at the Kitamura Wound Clinic in Pontianak-Indonesia from October 2019 to February 2020, after receiving approval from the Institute of Nursing Muhammdiyah Pontianak Review Board no. 305A/II.I.AU/Ket.ETIK/S-1/X/2019. The researchers surveyed and contacted a purposive sample of diabetic patients who were undergoing outpatient therapy in wound care at the clinic.

The criteria of the samples included patient who were admitted to the clinic for the first time, recurrently, and were undergoing treatment for not more than one week at the clinic. The study calculated the sample size based on a cross-sectional design sample size [13], with 76% of diabetic ulcers in the Kitamura wound clinic (unpublished data).

Two research assistants were trained regarding the study protocols collected the data, including the characteristics of the patient, vascular status assessment, neuropathy status, vital signs, HbA1C, wound assessment, and questionnaires. We tested peripheral neuropathy using Semmes-Weinstein monofilament (10-g) at six sites on the plantar aspect of both feet sites [14]. The study used the vascular assessment doppler vascular (Hadeco doppler, Inc., Japan) and classification of ABI (ankle brachial index) [15]. The research assistants analysed all the data using SPSS® version 20.0 (SPSS Inc, Chicago, IL).

3. Results

The study collected data with the selected participants (n = 292). In Table 1, the median and range age of the samples was 56 (27-87) years, and 55.1% of the samples were female. The positive neuropathy status was 30.8%, the mean (\pm SD) of systole blood pressure was 135.68 (23.9) and diastole was 83.02 (11.4). The median and range of HbA1C were 9.8 (6.44 - 14), and the ABI values range from 0.4 to 0.79 were ischemic and neuro-ischemic, while equal or over 0.8 were diabetic ulcers due to trauma, furuncles/carbuncles, neuropathic, or arterial dan venous. Ulcer locations included 38.4% on the toe, and in 47.9% of patients the cause of the ulcer was trauma (Table 2). Causes of trauma that lead to ulcers in diabetic patients included a needle, a nail puncture, scratching, shoes/sandal, bite from an insect, glass, fishbone, fall, nail clipper, animal bite, burn trauma, trauma massage and unknown causes. About 37.3% of the wounds in diabetic patients were diabetic bullae, 36% DUDT, followed by 9.2% furuncle and 8.6% neuropathic ulcer (Table 3). This study presents some samples of the characteristics of wounds that occur in diabetic patients which can be seen in figures A – I.

Table 1. Characteristic of patients and ABI classification

Variables (n =292)	
Age (median years)	56 (27- 87)
Sex n (%)	
Male	131 (44.9)
Female	161 (55.1)

Neuropathy no (%)				
Negative		201 (69.2)		
Positive		90 (30.8)		
Blood pressure mmHg				
Systole (mean ± SD)		135.68 ±23.9		
Diastole (mean ± SD)		83.02 ± 11.4		
HbA1c % median (no)		9.8 (6.44 – 14)		
Type of ulcers, n (%)	ABI Classification			
	≤ 0.39	0.4–0.59	0.6–0.79	≥ 0.8
DUDT				105 (37.4)
Diabetic bullae			3 (1.07)	106 (37.7)
Arterial			5 (1.78)	1 (0.36)
Venous				2 (0.71)
Mix V/A			2 (0.71)	
Neuropathic				24 (8,54)
Ischemic		3 (1.07)	1(0.36)	
Furuncle				27 (9.61)
Neuro-ischemic		1 (0.36)	1 (0.36)	

Table 2. location of wound in diabetic patients

Variables (n =292)	
Location of wound no (%)	
Toe	112 (38.4)
Dorsal	41 (14.0)
Plantar	72 (24.7)
Lateral	17 (5.8)
Heel	13 (4.5)
Malleolus	3 (1.0)
Crural	7 (2.4)
Sural	3 (1.0)
Feet to lower leg	2 (0.7)
Knee	2 (0.7)
Hand	2 (0.7)
Neck	5 (1.7)
Scapula	2 (0.7)
Gluteal	9 (3.1)
Axilla	2 (0.7)

Table 3. Cause and type of diabetic ulcer patients

Variables (n=292)	
Trigger of wound no (%)	
Trauma	140 (47.9)
Diabetic Bulla	116 (39.7)
Unknown	36 (12.3)
Type of ulcer no (%)	
DUDT	105 (36.0)
Diabetic bullae	109 (37.3)
Venous	2 (0.7)

Arterial	6 (2.1)
Mix ulcer	2 (0.7)
Ischemic	4 (1.4)
Neuropathic	25 (8.6)
Neuro-ischemic	2 (0.7)
Furuncle (boils)	27 (9.2)



Figure A. DUDT



Figure B. Ischemic ulcer



Figure C. Arterial ulcer



Figure D. Neuropathic ulcer



Figure E. Mix ulcer



Figure F. neuro-ischemic



Figure G. Furuncle/carbuncle



Figure H. Venous ulcer



Figure I. Diabetic bullae

3. DISCUSSION

In our study, we found that the great majority of the ulcer locations in diabetic patients included the toe followed by the plantar, dorsal, lateral, and heel, and this study confirmed the results of a previous study [16]. This study presents the category or characteristic of ulcers in diabetic patient. Our study found some characteristics of ulcers that occurred in

diabetic patients including DUDT, venous, mixed ulcer, arterial, venous, neuropathic, neuro-ischemic, diabetic bullae and furuncle/carbuncle.

Diabetic ulcer due to trauma (DUDT)

This study found that most common diabetic ulcers were due to trauma. The DUDT patients in the study showed ulcer characteristics that were unlike the signs or symptoms of ischemic ulcers (pale, yellow, cold, weak or absent pulse), neuropathic ulcers (ulcer often preceded by callus formation) arterial ulcers (very painful, punch out an ulcer, skin shiny, reduced hair growth, pallor on leg elevation, weak or absent pulse and delayed capillary refill), neuro-ischemic ulcers (abnormal ABI) and peripheral neuropathic ulcers [17,18] This study concludes that ulcers can be caused by various types of trauma and the appearance of such ulcers differs from other types of diabetic ulcers such as neuropathic, ischemic, neuro-ischemic, arterial, venous and others. This kind of ulcer may also be a neuropathic and/or ischemic ulcer, depending on the pathological contribution of the PAD (peripheral arterial disease) and/or neuropathy. This means that patients with diabetic ulcers due to trauma may have a high risk of a worse prognosis. However, patients with diabetic trauma ulcers may demonstrate faster healing or repair of the wound, so long as the ABI value is equal or above 0.8[19] and there are no other factors such as neuropathy, PAD, infection, older age, cigarette smoking, poor glycaemic control, previous foot ulceration or amputations, and ischemia of small and large blood vessels [20,21].

This study also presented DUDT occurring at the hand location, which is not commonly reported. This study postulates that DUDT is an ulcer that occurs in diabetic patients due to multi-factor trauma ,with manifestations of ulcers that do not have the following signs and symptoms: callus formation or hyperkeratosis, ischemic; ABI 0.8 above and location of the wound, which can affect both extremities and/or another part of the body.

Neuropathic ulcer

This ulcer has a specific characteristic and most commonly occurs in the plantar sites. The characteristic of neuropathic ulcers is that they are covered by callus or fibrotic tissue and by the trimming of hyperkeratotic tissue.²¹ This study found that 8.2% of diabetic patients had neuropathic ulcers. Neuropathic ulcers result from a loss of peripheral sensation, and ulceration begins due to increased pressure, such as over the prominent metatarsal heads or on the toes, interdigital surfaces, or bony prominences over various foot deformities and trauma [19-21]. This study found that some neuropathic ulcer patients presented the characteristics of the appearance of these types of ulcer. The description of neuropathic ulcers is likely to depend on the severity of neuropathy status, along with various causative factors [22].

Arterial ulcer

This study found that 2.1% of diabetic patients had arterial ulcers. Arterial ulcers are due to a reduced arterial blood supply to the lower limb, and the most common cause is atherosclerotic disease of the medium- and large-sized arteries [22]. Another study reported that arterial ulcers also refer to ischemia ulcers [18]. This study presented all patients who had arterial ulcers with ABI values ranging from 0.5 to 0.8 and which felt painful [23]. These patients' ABI values showed an ischemia condition; however, the ulcer in this study illustrated the specific characteristics of ulcers, such as features, skin temperature and colour,

the sensation of pain, pulse, and location of the ulcer [19]. Patients who have ABI values that are equal or greater than 0.8 showed no risk for ischemic ulcers, but these were still possible if the patients were not given appropriate treatment. Arterial ulcers may cause an expansion of the lesions, extensive ischemia, and infection and even amputation of extremities, which also depend on mild to severe conditions due to PAD in diabetic patients [24].

Venous ulcer

This study showed that only 0.7% of venous ulcer patients had an ABI over 0.8. Based on a review of the literature, there has been very little published that deals with the problem of diabetic patients with chronic venous ulcers. A venous ulcer that occurs in patients with diabetes may be due to complications. Another study reported that diabetic patients with chronic venous ulcers based on diagnosis evaluated not only decreases in arterial perfusion but also found pathological venous insufficiency, which results in extensive oedema and can further compromise the circulation of the affected extremity [25].

Mixed ulcer

Another study reported that mixed venous and arterial ulcer have predominantly venous causes combined with detectable arterial impairment with an ABI from 0.7-0.9, and mixed arterial and venous ulcers have predominantly arterial causes combined with a minor venous insufficiency - usually superficial with an ABPI (ankle brachial pressure index) generally 0.7 or lower [10]. Our study found that mixed ulcers seemed to be more likely in the ABI range of 0.6 to 0.8 [19,20]. This is because ABI values of less than 0.6 are more likely to lead to ischemic ulcers and the high risk of a worsening prognosis [24]. Another point to note is the relation of the improvement of ischemic conditions with an ABI value of equal to or greater than 0.5 and increased ABI values, which will depend on the patient's condition and the therapy that is given [25,26].

Neuro-ischemic ulcer

Neuro - ischemic ulcers are diagnosed in patients with neuropathy and peripheral arterial disease, as defined by an ankle-brachial index (ABI) ≤ 0.9 [27]. This study found that only 0.7% of diabetic patients who had neuro-ischemic ulcers, compared to another study that reported 29.9% [28]. Our findings are likely different due to the clinical setting, number of samples, characteristic samples, and study design. This study also presented ABI values that were greater than or equal to 0.6. The characteristics of neuro-ischemic type ulcers accompany the original appearance such ulcers, namely the presence of ischemic signs and changes in peripheral sensations that cause peripheral neuropathy.

Ischemic ulcer

This study found that 0.7% of ischemic ulcer diabetic patients had an ABI < 0.5 , which showed an ischemic condition. This study demonstrated that all such patients had the typical clinical manifestations of such ulcers, which were pale, cold, and had an absent pulse. These symptoms are most commonly seen in ischemic ulcers [5]. The clinician may find it difficult to distinguish between arterial and ischemic ulcers.

This study found differences in the clinical appearance of arterial and ischemic ulcers. The differences in the signs and symptoms arising from ischemic and arterial ulcers include ABI

values. Therefore, it is necessary to understand the clinical manifestations and results of ABI to differentiate arterial and ischemic ulcers.

Furuncles/carbuncles (boils)

Furuncles/carbuncles (boils) refer to the infective gangrene of the skin and subcutaneous tissue, which is most commonly caused by staphylococcus aureus, which usually starts as a furuncle/boil around the root of a hair follicle [7]. The furuncles/carbuncles (boils) findings were 9.2% in this study, and the location of the ulcer was more dominant in the gluteal area compared to the nape of the neck area [29]. This study findings of furuncle/carbuncle type ulcers in diabetic patients are high. This is because furuncles/carbuncles are a complication of diabetes and, as such, need to be treated seriously [7,29].

Diabetic bullae

Several studies regarding diabetic bullae have been reported, and it is known that the causes of skin disorders in diabetic patients are multifactorial.

This study found a large percentage of diabetic bullae, and the patient did not recognize the cause of the bullae or blister formation. Patients with diabetic bullae have known blisters due to minor trauma or after exposure to ultraviolet light [30]. Microangiopathy may play an etiological role according to reports of some investigators. Other proposed contributing factors include immune-mediated vasculitis, and impaired metabolism of calcium, magnesium, or carbohydrates, tissue hypoxia and microcirculation ischemia [9,31]. We found that ABI values in diabetic bullae less than 0.8 (1.07%), it is maybe associated with microangiopathy.³¹ While, ABI values above 0.8 may be resulted by various factors that are not yet clearly known in this study.

The present study identifies the importance of characteristic ulcers that occur in diabetic patients. Diabetic ulcer patients can be categorized as DUDT or as having ulcers that are neuropathic, ischemic, neuro-ischemic, mixed (venous–arterial), diabetic bullae, arterial, venous, or furuncle/carbuncle (boils). The difference among these ulcers that occur in diabetic patients is necessary for differentiating the appropriate treatments for distinct types, prognoses and avoid infection.

The limitation of this study is that it did not use a diagnostic test with sophisticated technology to evaluate the description of the vascular status in order to determine the cause and effect, but rather addressed clinical characteristics only. Some data obtained from questionnaires and medical records were likewise subject to bias. Last, the present findings cannot be generalized to other populations with backgrounds that are different from our study population.

4. CONCLUSION

This study identified some differences among diabetic patients who had wounds by their characteristics. These findings may provide a better target for clinical practice approaches in the management of diabetic ulcers based on type. Diabetic ulcers can have multifactorial causes and can feature a special characteristic ulcer, depending on the specific cause. Further studies on diabetic ulcers that address their type are warranted for the development of more accurate and practical systems to facilitate the early identification of aetiology, individuals

who are at risk of ulceration, the best treatments for each type of wound, healing progression and prevent infectious complications.

Conflict of interest

The author declares that there is no conflict of interest.

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