ORIGINAL ARTICLE

Characteristics and management of patients undergoing emergency surgery for diabetic foot attack

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ABSTRACT

BACKGROUND: Diabetic foot attack (DFA) is considered one of the worst manifestations of diabetic foot. It is necessary to act quickly to prevent amputation and save the patient's life. The aim of this study is to reveal the characteristic features of DFAs and be a guide to healthcare professionals to manage and refer these patients.

METHODS: Sixty-five patients with DFAs were analyzed retrospectively. Demographics were collected. All patients' infectious diseases Society of America/International Working Group on the Diabetic Foot (IDSA/IWDGF) stages, ischemia site neuropathy, bacterial infection and depth (SINBAD) and laboratory risk indicator for necrotizing fasciitis (LRINEC) scores were calculated. According to these measurements, patients were categorized and statistical results were obtained.

RESULTS: We found that patients who underwent emergency surgery due to DFA applied to an average of two hospitals before applying to our facility and the median acceptance time since the beginning of the first complaint was 9 days. All patients were IDSA/IWDGF stages three and four. Most of the patients had SINBAD scores between four and six. 60% of the patients were at high risk for necrotizing fasciitis according to the LRINEC score. 58.2% of patients had periferic arterial stenosis and the amputation rate was 69.2%. In the intensive care unit, 21.3% of the patients were followed in the intensive care unit, and our patients' mortality rate was 4.2%.

CONCLUSION: DFA is an emergency surgical condition that requires high clinical suspicion. If not diagnosed and treated with emergency surgery, it has a high mortality and amputation rate. High white blood cell count in patients, local and systemic signs of inflammation, presence of subcutaneous emphysema in the lower extremities on a direct X-ray radiography, and high blood sugar should be considered as warning signs for DFA. Emergency surgical intervention should be performed on these patients, and if the patient is not in a suitable center for emergency surgery, they should be rapidly referred to a center with experienced clinicians.

Keywords: Diabetic foot attack; diabetic foot; emergency surgery.

INTRODUCTION

Diabetes mellitus (DM) and its related complications are becoming increasingly common worldwide. According to the data from the World Health Organization, the number of patients with DM has increased from 108 million in 1980 to 422 million in 2014.[1] Diabetic foot ulcers (DFU) have an important place among the increasing complications. According to the International Diabetes Foundation, 40 million to 60 million persons worldwide have DFU, a significant increase from the 2015 estimates, which ranged from 9 million to 26 million.[2] Of patients with DM, 19%–34% will be affected by DFU during their lifetimes, regardless of the duration of diabetes diagnosis.[3] DFU can cause social, economic, and psychological losses in patients and its most important undesirable result is amputation. According to a previous report, a lower extremity is amputated due to DM every 30 s.[4]

On the other hand, diabetic foot attack (DFA) is considered an acute life-threatening emergency among patients with DFU, but its definition, diagnosis, treatment and the appropriate department to refer the patient remains controversial

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in the literature.[5] Many triggering factors have been revealed for this emergency, which can affect the limbs within hours if intervention is not initiated and pose a high mortality risks such as peripheral vascular disease, greater ulcer size/severity, underlying osteomyelitis, delayed presentation, and most importantly of all, inadequate organizational care for the diabetic foot.[6] According to the Eurodiale study, the severity of the disease at the time of presentation to specialized foot clinics, which is influenced by delays in the care process, could account for some of the disparities in amputation rates between European centers.[7]

Hence, early recognition of DFA and quick intervention or referral to the appropriate center are important. If the aggressive treatment necessary to save the patient's life is delayed, the mortality risk and mortality rate increase. The primary purpose of this study was to identify the characteristic features of DFA on the basis of data from the current guidelines. The secondary aim was to guide primary/secondary health-care personnel on the parameters that will enable them to identify diabetic foot emergencies and refer them to advanced centers based on these features.

MATERIALS AND METHODS

This single-center, retrospective study was conducted at Ankara Bilkent City Hospital, Department of General Surgery Chronic Wound Unit, between June 1st, 2022, and January 1st 2023. Patients admitted to the unit due to diabetic foot were evaluated. Patients diagnosed with DFA according to their clinical findings and underwent surgery, endovascular lower extremity revascularization, or patients with acute Charcot's neuro-osteoarthropathy. Patients with chronic DFU infection, chronic lower extremity ischemia, and chronic Charcot's neuro-osteo-arthropathy condition were excluded from the study. Their medical data were collected from the hospital database. This study was conducted with the approval of the Ankara Bilkent City Hospital Ethics Committee (E2-22-2878/November 23, 2022).

Basic patient information on demographics, vital signs, laboratory test results, length of hospital stay, and comorbidities such as coronary artery disease, congestive heart failure, chronic kidney disease, and chronic obstructive pulmonary disease were collected. In addition, radiological results obtained from direct X-ray radiography (X-ray) Doppler ultrasonography (USG), computed tomography angiography (CTA), carbon dioxide angiography (CO2 angiography), and digital subtraction angiography (DSA) were noted. The surgery types and the number of surgeries were also recorded.

To categorize the patients and assess the severity of their disease, different scoring systems were used. Carlson's Comorbidity Index (CCI)[8] was used to define the patients' morbidity and operative risks. The International Working Group on the Diabetic Foot (IWGDF) has been publishing evidence-based guidelines on the prevention and management of diabetic foot disease since 1999. They recommend: Site ischemia neuropathy, bacterial infection, and depth (SINBAD) score system (that includes site, ischemia, neuropathy, bacterial infection, and depth) for the assessment of wound characteristics; the Infectious Diseases Society of America/IWGDF (IDSA/IWGDF) classification for the assessment of diabetic foot disease.[9] In this study, SINBAD score system and IDSA/IWGDF classifications were used to categorize the patients. The SINBAD score system is simple and quick to use, requires no special equipment beyond clinical examination alone, and contains the necessary information to allow for triage by a specialist team (Table 1).[10] The IDSA/IWGDF classification consists of four grades of diabetic foot infection

Table 1. SINBAD system

Category	Definition	Score
Site	Forefoot	0
	Midfoot and hindfoot	1
Ischemia	Pedal blood flow intact:at least one people pulse	0
	Clinical evidence of reduced pedal flow	1
Neuropathy	Protective sensation intact	0
	Protective sensation lost	1
Bacterial İnfection	None	0
	Present	1
Area ulcer	Ulcer <1 cm2	0
	Ulcer ≥1 cm2	1
Depth	Ulcer confined to skin and subcutaneous tissue	0
	Ulcer reaching muscle, tendon or deeper	1
Total possible score		0–6

SINBAD: Site ischemia neuropathy, bacterial infection and depth

Table 2. IDSA/IWGDF system

Clinical manifestations	Infection severity	PEDIS Grade
Wound lacking purulence or any manifestations of inflammation	Uninfected	1
Presence of ≥2 manifestations of inflammation (purulence, or erythema, tenderness, warmth, or induration), but any cellulitis/erythema extends ≤2 cm around the ulcer, and infection is limited to the skin or superficial subcutaneous tissues; no other local complications or systemic illness	Mild	2
Infection (as above) in a patient who is systemically well and metabolically stable but which has ≥1 of the following characteristics: cellulitis extending >2 cm, lymphangitic streaking, spread beneath the superficial fascia, deep-tissue abscess, gangrene, and involvement of muscle, tendon, joint or bone	Moderate	3
Infection in a patient with systemic toxicity or metabolic instability (e.g. fever, chills, tachycardia, hypotension, confusion, vomiting, leucocytosis, acidosis, severe hyperglycaemia, or azotaemia)	Severe	4

IDSA/IWDGF: Infectious diseases society of america/international working group on the diabetic foot.

(Table 2).[10] It was originally developed as part of the PEDIS classification for research purposes and is used as a guideline for management, in particular to identify which patients require hospital admission. Moreover, laboratory risk indicator for necrotizing fasciitis (LRINEC) scores were calculated to determine if DFA could be evaluated in the same way as necrotizing fasciitis. Patients with LRINEC scores ≥6 were categorized as at a high-risk group for developing necrotizing fasciitis (Table 3).[11]

Patients with DFA are normally divided into three groups: infective, acute critical ischemia, and Charcot's neuro-osteoarthropathy.[10] However, as none of the patients in the present study had a predominant ischemia finding, they were categorized as either those with or those without an ischemic component. Statistical calculations were made to understand the factors that predispose diabetic patients to different types of DFA or to factors that affect amputation decisions.

Table 3. LRINEC score

Parameter	Range	Score
Hb (g/dL)	>13.5	0
	11–13.5	1
	<11	2
White cells (109/L)	<15	0
	15–25	1
	>25	2
Sodium (mmol/L)	<135	2
Creatinine (μmol/L)	>141	2
Glucose	>10	1
C-reactive protein	>150	4

aScore ≤5 = <50% risk (low); 6–7 = intermediate risk; ≥8 = >75% risk (high). LRINEC: Laboratory risk indicator for necrotizing fasciitis.

IBM Statistics SPSS version 20 was used for data analysis. Standard deviations and Student's t-test were used for the analysis of the parametric data mean; and interquartile range (IQR) and Mann-Whitney U test was used for the non-parametric data median. A $P<0.05$ was considered statistically significant.

RESULTS

In this study, 65 patients were included. The cases were categorized as an infective, infective ischemic, and neurogenic emergency, of which the most common was infective ischemic emergency (55.3%), followed by infective emergency (43%). The patients' mean age was 59.51±10.8 years. Of the patients, 80% (52 patients) were male and 80% were smokers. The smoking rate was significantly higher among the male than the female patients (88.5% vs. 46.2%, $P<0.01$). The most common diseases were coronary artery disease (47.7%) and congestive heart failure (21.5%). The overall mortality rate was 4.6% (3 patients). The median length of hospital stay was 50 days (IQR, 21–74.50 days) and 21.5% of the patients were followed in the intensive care unit before and after surgery owing to comorbidities and septic shock. All patients had applied to at least two other hospitals before being accepted at the present facility, and the median acceptance time since the first complaint was 9 days (IQR, 3–14 days).

The comparison of the patients according to the scoring systems is as follows: The overall median CCI was five (IQR, 4–6). According to LRINEC scores ≥6, 60% (39 patients) of the patients were at high risk of necrotizing fasciitis. The SINBAD scores were 4, 5, 6, and 3 in 36.9%, 33.8%, 26.2%, and 3.1% of the patients, respectively. All patients were category 3 (moderate; 30%) and 4 (severe; 70%) according to the IWGDF stage. All patients were evaluated with at least one radiological examination and with X-ray additionally. The

Table 4. Comparison and statistical results between infective/infective-ischemia, LRINEC low/high risk, amputation negative/positive

Variables	Infective (n=26)	Infective-İschemia (n=38)	P	LRINEC Low Risk (n=26)	LRINEC High Risk (n=39)	P	Amputation (-) (n=20)	Amputation (+) (n=45)	p
Age*	57.46±11.4	60.7±10.45	0.245	59.27±11.9	59.67±10.1	0.890	58±11	60±11	0.603
Gender†	17(65.4) male	34(89.5) male	0.01<	21(80.8)	31(79.5)	0.899	17(85) male	35(77.8) male	0.739
Smoking†	19(73.1)	32(84.2)	0.277	21(40.4)	31(59.6)	0.899	15(75)	37(82.2)	0.517
Coronary Artery Disease†	6(9.4)	25(65.8)	0.001<	11(42.3)	20(51.3)	0.478	6(30)	25(55.6)	0.05<
Chronic Obstructive Lung Disease†	3(11.5)	6(15.8)	0.728	6(23.1)	3(7.7)	0.079	3(15)	6(13.3)	0.857
Heart Failure†	4(15.4)	10(26.3)	0.299	5(19.2)	9(31.1)	0.712	4(20)	10(22.2)	0.841
Chronic Kidney Failure†	4(15.4)	8(21.1)	0.747	5(19.2)	7(17.9)	0.896	3(15)	9(20)	0.632
Intensive Care†	1(3.8)	13(34.2)	0.05<	2(7.7)	12(30.8)	<0.05			
Death†	0(0)	3(7.9)	0.265	0(0)	3(7.7)	0.148	1(5)	2(4.4)	0.922
Carlson Comorbidity İndex‡	4(3-5)	6(4-7)	0.005<	5(3-7)	5(4-6)	0.564	4(3-6)	5(4-6)	0.212
SINBAD Score†									
3	2(7.7)	0(0)	0.375	2(7.7)	0(0)	0.063	1(5)	1(2.2)	0.05<
4	9(34.6)	14(36.8)		4(54.2)	11(28.2)		12(60)	12(26.7)	
5	5(30.8)	14(36.8)		5(23.1)	16(41)		2(10)	20(44.4)	
6	6(26.9)	10(26.3)		6(39.4)	12(30.8)		5(25)	12(26.7)	
LRINEC High Risk†	14(53.8)	25(65.8)	0.336				9(45)	30(66.7)	0.1
Infective-Ischemic†				13(52)	25(64.1)	0.336	7(36.8)	31(68.9)	0.01<
Hemoglobin*	10.8±2.13	11.05±2.40	0.665	12.03±2.33	10.32±2.04	0.003	11.42±2.21	10.82±2.35	0.335
White Blood Count*	17.1±6.31	17.21±5.73	0.947	14.28±4.25	18.96±6.16	0.001	17.06±6.07	17.1±5.91	0.982
HbA1c‡	9.9(9.20-11.30)	9.55(8.5-10.5)	0.280	9.5(9-10.3)	10.1(8.5-11.5)	0.369	9.55(9.05-10.55)	9.9(8.9-11.3)	0.771
Homocysteine†	13.95 (11.9-18.85)	17.3 (13.3-23)	0.196	15.95 (13.3-19.45)	14.3 (12.2-19.1)	0.619	15.95 (14-19.2)	14.10 (12.2-21.1)	0.498
Glucose*	236.96±133.75	242.68±112.05	0.854	234.77±110.38	244.49±126.33	0.751	222.7±139.07	246.33±110.1	0.566
Albumin‡	3.35(3-3.9)	3.6(3.2-3.9)	0.480	3.75(3.3-4.2)	3.4(3-3.9)	<0.05	3.45(3-4)	3.6(3.1-3.9)	0.623
CRP*	178.04±82.67	191.20±94.06	0.557	105.89±47.9	235.96±69.36	0.001	15.28±70.3	198.6±93.5	0.05<
Sodium‡	134(130-138)	134(131-136)	0.641	135.5(133-138)	132(130-135)	<0.01	135(132-138)	133(130-136)	0.07
Wound Culture†									
Gram(+) basil	9(34.6)	5(13.2)	0.064	5(19.2)	9(23.1)	0.308	5(25)	9(20)	0.342
Gram(+) rod	4(15.4)	11(28.9)		9(34.6)	6(15.4)		7(35)	8(17.8)	
Gram(-) Aerobe	4(15.4)	2(5.3)		3(11.5)	4(10.3)		2(10)	5(11.1)	
Gram(-) Anaerobe	9(34.6)	20(52.6)		9(34.6)	20(51.3)		6(30)	23(52.2)	
Amputation†	14(53.8)	31(81.6)	0.05<	15(57.7)	30(76.9)	0.1	n/a	n/a	n/a
Finger	12(80)	21(67.7)	0.596	12(80)	21(67.7)	0.775	n/a	n/a	n/a
Amputation Type†									
Metatarsal	2(13.3)	3(9.7)		1(6.7)	4(12.9)				
Transtibial	1(6.7)	6(19.4)		2(13.3)	5(16.1)				
Transfemoral	0(0)	1(3.2)		0(0)	1(3.2)				
Fasciotomy†	4(15.4)	2(5.3)	0.172	2(7.7)	4(10.3)	0.726	3(15)	3(6.7)	0.361

*Values presented as mean ± standard deviation; †Values presented as number of patients(percentage); ‡Values presented as median days(25 percentile-75 percentile)

most common radiographic findings were subcutaneous emphysema in the lower extremities (60%) and foot bone osteomyelitis (26.1%). Of the 49 patients who underwent CTA, 61.2% (30 patients) had stenosis. All patients with stenosis, including the six patients with chronic kidney disease who were found with stenosis on USG, underwent DSA. CO2 angiography was performed for the six patients with chronic kidney disease. In the 36 patients with stenosis, DSA was successful in 91.4% for revascularization. USG was performed in 47 patients, of whom 22 (46.8%) were susceptible to stenosis. Of the 22 patients, two had normal CTA findings and one had normal USG findings but was found with stenosis on CTA. Thus, USG successfully detected 94.4% of the cases.

In the present study, bacterial growth was present in the deep tissue cultures from all patients. The most common bacteria were Escherichia coli (11, 18.6%), followed by streptococci (8, 13.6%). Gram-negative anaerobes were the most common bacterial type, accounting for 44.6% of the bacterial population. Gram-positive bacilli were present in 21.5% of the samples; Gram-positive cocci, in 23.1%; and gram-negative aerobic bacteria, in 10.8%.

The most common surgical intervention performed for the patients was amputation with debridement (69.2%). For 19 of the remaining 20 patients, only debridement was performed. The patient with acute Charcot foot received offloading and high-dose steroid therapy. The distribution of the types of amputation performed was as follows: finger amputation, 69.2% (45 patients); metatarsal amputation, 9.2% (6 patients); transtibial amputation, 10.8% (7 patients); and transfemoral amputation, 1.5% (1 patient). Fasciotomy was performed with other surgeries in only 6 patients (9.3%). The median number of operations performed for each patient was 2 (IQR, 1–3), and repeated debridement was the most frequent surgery.

The patient who underwent the most surgery was operated on 11 times which was recurrent debridement.

In Table 4, the patients were categorized according to emergency type, LRINEC score, and whether amputation was performed or not. The patients with infective ischemia had a significantly higher incidence rate of coronary artery disease (65.8% vs. 9.4%) and CCI scores (median [IQR]: 6 [4–7] vs. 4 [3–5], P<0.005). As expected, the patients with infective ischemia had a higher amputation rate (81.6% vs. 53.8%). Even though we found no significant difference in bacterial growth in the wound cultures of all patients, the bacterial population rate of gram-negative anaerobes in the cultures of the patients with infective ischemia was higher (52.6% vs. 34.4%). The LRINEC high- and low-risk categories did not significantly differ between the patients, except for white blood cell count, hemoglobin level, C-reactive protein (CRP) level, and sodium level, which are the components of the LRINEC score. The patients who underwent an amputation had higher SINBAD scores and CRP levels. Similarly to the patients with infective ischemia, they had a higher population rate of gram-negative anaerobic bacteria in their cultures.

DISCUSSION

DFA is an emergency that many physicians are unaware of because of complicated and unstandardized definitions and lack of knowledge.[12] Diabetic foot, which is considered a chronic disease under normal conditions, is not predicted to be life-threatening in some cases.[13] DFA is considered one of the worst manifestations of diabetic foot. An intensely inflamed foot with quickly progressing skin and tissue necrosis, occasionally accompanied by substantial systemic symptoms, is observed in the infective presentation of DFA. In such cases, it is necessary to act quickly to prevent amputation and save the patient's life. As this acute condition is not easily detected, most patients apply to more than one hospital to obtain the correct diagnosis and treatment. Therefore, although these patients can be saved with a simple treatment, they usually end up with organ amputation.[14] In our study, we found that the patients who underwent emergency surgery due to DFA had applied to an average of two hospitals before applying to our facility. In addition, the high amputation rate of 69.2% was attributed to the fact that the patients were not referred to the appropriate facility, and cases that required emergency surgery were not detected in previous centers.

Many classification systems have been proposed for DFU but the classifications currently used have bias and are not useful enough to determine emergency cases in daily clinical practice.[15,16] In this study, we used the IWGDF staging system to define infection severity and the SINBAD scoring system to define diabetic wound characteristics. However, all patients had a high white blood count and showed fever or a local wound infection site >2 cm, which were considered features of IWDGF stages three and four. In addition, most patients had SINBAD scores between four and six due to the long-term absence of treatment. Emergency surgical debridement is recommended for patients with IWDGF stages three and four, and the fact that all our patients were in this category in the retrospective evaluation indicates that the patients were managed under the correct diagnosis.[17] These high scores of the patients who applied to our center indicate that they had a severe and limb-threatening stage of infectious DFA, but it is also possible that some patients with low scores had DFA. In addition, although no classification system has been established as infective and infective ischemic DFA, we created such a categorization to understand the demographic differences in patients with ischemia. As the patients with DFA who had acute critical ischemia presented to our clinic when late or secondary infections had already developed, we did not examine the characteristics of and treatment modalities used in this patient group. In our categorization, we found that the patients with ischemic components were composed of statistically significantly more males than females, had higher CCI values, and accounted for 81% of the patients who underwent an amputation. In addition, when all amputees and non-amputees were categorized, we found that the SINBAD score was <5 in 65% of the non-amputees and was ≥5 in 71.1% of the amputees.

A previous study with diabetic patients reported that the

LRINEC score was useful in understanding the progression of the infection and the need for surgical treatment.[18] When we categorized the patients as high- and low-risk according to their LRINEC scores based on their biochemistry findings during hospitalization, we could not find any significant difference in demographic characteristics and surgeries performed, although the proportion of the group with a high risk of necrotizing fasciitis was higher (60%). However, when evaluated together with our clinical findings, this score may be useful for correct management and referral of patients.

There are issues that should be considered in the management of patients admitted to the hospital with DFA. Upon hospitalization, the patients' glucose regulation, fluid replacement, and metabolic values should be evaluated. Our patients with uncontrolled diabetes had a median glucose level of 226 mg/dL (IQR, 156–293 mg/dL) and glycated hemoglobin (HbA1c) value of 9.80 (9–11.1). The foot should be carefully examined for signs of local inflammation and ischemia. During patient history taking, the patient should be asked whether there are new findings in the foot. The first imaging method to be performed should be X-ray. In our study, osteomyelitis was found in 26.1% of the patients on X-ray. Subcutaneous emphysema in the lower extremities, which is an important finding indicating the severity of the infection, was found in 60% of the patients. In addition, all peripheral pulses should be checked to determine whether there is an ischemic component in the DFA. CTA can be performed in suspected patients with normal kidney functions. Of our patients, 61.2% showed signs of vascular stenosis on CTA. In the present study, USG had an accurate diagnosis rate of 94.4%, consistent with the reports in the literature.[19] Thus, it can be used safely in centers without CTA equipment or in patients who are unsuitable for receiving contrast medium. CO2 angiography allowed for successful diagnosis and treatment in cases where USG revealed suspicious findings or was used in the initial diagnosis. In our study, CO2 angiography was successfully performed in six patients, with positive results.

After the first evaluation, patients should immediately undergo surgery, and the "time is tissue" principle should be adopted.[5] Figure 1 shows an image of the foot of a patient presenting with infective DFA at the time of diagnosis. Radiological findings and a post-treatment image are also shown. A previous study reported that early recognition of these emergency cases and intervention with aggressive debridement in the first 72 h can reduce the risk of transtibial amputation.[20] Debridement is recommended within 24 h, especially in patients with a CRP level >100 mg/L and the median CRP level in our study was 180 mg/L (IQR, 108–242 mg/L). The most common, fastest, and most effective surgical treatment in terms of preventing progressive focal infection is the debridement of necrotic tissues, infected areas, and abscesses.[21] All necrotic tissues should be excised during debridement. A skilled surgeon should investigate all foot compartments suspected of infection, including the deep central compart-

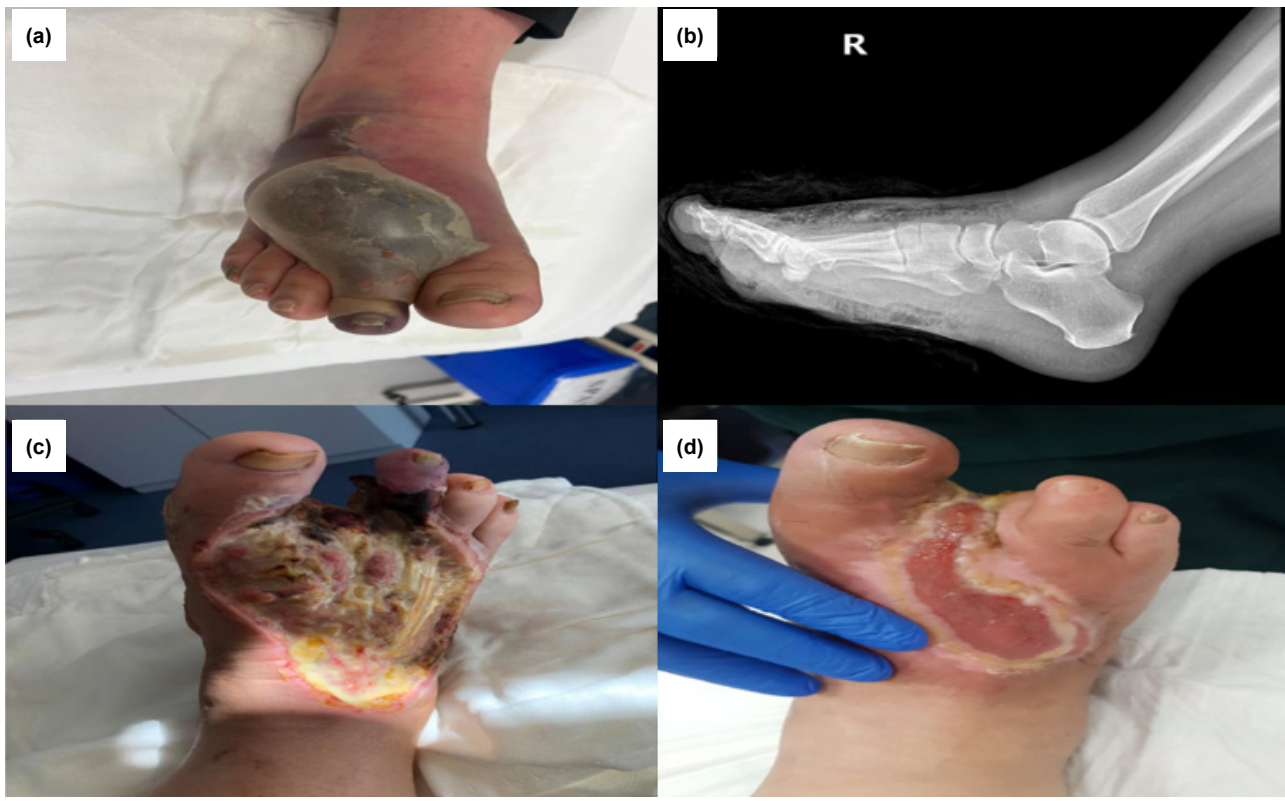

Figure 1. Follow-up process of a patient presenting with diabetic foot attack. **(a)** Infected state at the time of diagnosis **(b)** Inflammation and air finding on direct radiograph. **(c)** Condition after first debridement **(d)** Formation of granulation tissue after repetitive surgeries.

ment.[22] Amputation should be kept to a minimum, but ischemic gangrenous limbs that can be a potential source of infection should be removed. In the present study, only 29.3% of the patients successfully underwent debridement without amputation, which is another important outcome in patients hospitalized at an advanced stage and receiving delayed treatment. While the above-ankle amputation rate among the patients with DFA was 17.6% in general,[23] in our study, this rate was 12.3% even though the patients had undergone emergency surgery, and a mortality rate of only 4.2% was observed. For this reason, our results can be considered more successful than those reported in the literature.

After the first surgical intervention, revascularization should be performed as soon as possible. In principle, revascularization should be delayed until after the first debridement. Providing vascular blood supply in the early period after debridement increases treatment success in patients with DFA without peripheral vascular blood supply. In our series, 94.4% of all revascularization cases were achieved with DSA. Acute ischemic DFA can occur without infection. Revascularization should be considered primarily in such patients, but none of our patients presented with this condition at our clinic.

Antibiotic therapy should also be considered during treatment. Staphylococcus aureus is the most frequently isolated bacterium in different studies, but patients should also be screened for methicillin-resistant S. aureus, and empirical antibiotic therapy should be recommended.[24] However, in the present study, gram-negative anaerobes were found to be the most common bacteria, accounting for 44.6% of bacterial growth. The large number of subcutaneous emphysema in the lower extremities findings observed on X-ray is compatible with our patients' clinical findings. In a previous study, the use of antibiotics in the previous month, previous foot wound or osteomyelitis, previous amputation history and active dressing use, and intensive care hospitalization were defined as risk factors of Gram-negative bacterial infection.[25] We believe that empirical treatment in emergency cases, including gram-negative bacterial infection, would be the right approach, especially for patients with advanced diseases.

Long hospital stays and repetitive operations are inevitable outcomes in patients hospitalized for DFA. In these patients, healthy tissue could not be obtained with a single debridement. The number of debridement, which was as high as 11 in our cases, and the median number of two operations are important in this respect. The most important benefit of repeated debridement is that it prevents the formation of a biofilm layer and reduces the inflammatory load. In addition, it helps in the formation of granulation tissue by increasing the release of growth factors.[26] In addition, offloading and negative pressure wound therapy between debridement contribute to wound healing by increasing local blood supply and angiogenesis.[27]

The fact that we did not obtain a distinctive statistical result for the patients with infective and infective ischemia, LRINEC low- and high-risk patients, and patients with and without amputation in our classifications shows that team experience and clinical observation are more important than the use of scoring systems in DFA management. We think that because all our patients had an elevated white blood cell count, local and systemic inflammation findings, subcutaneous emphysema in the lower extremities on X-ray, and lack of blood glucose regulation, with these parameters and emergency could be considered, an emergency could be considered, and referral to an advanced center should be provided. Patients' lives can be saved with limited amputation by performing an emergency surgical procedure and completing revascularization as soon as possible after patient evaluation by an experienced clinical team.

As far as we know, our study has an acceptable patient population for this rare acute condition. The limitation of our study is that all included patients received treatment when they were at an advanced stage and its retrospective nature. More successful results can be obtained by developing classification systems in studies with larger patient populations and informing doctors about this emergency.

CONCLUSION

DFA is an emergency surgical condition that requires high clinical suspicion. If not diagnosed and treated with emergency surgery, it can result in high mortality and amputation rates. High white blood cell counts, local and systemic signs of inflammation, presence of subcutaneous emphysema in the lower extremities on an X-ray, and high blood glucose levels should be considered warning signs of DFA. Emergency surgical intervention should be performed for these patients, and patients admitted to a center for unsuitable emergency surgery should be rapidly referred to a center with experienced clinicians.

Ethics Committee Approval: This study was approved by the Bilkent City Hospital Ethics Committee (Date: 07.12.2022, Decision No: E2-22-2975).

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ORİJİNAL ÇALIŞMA - *ÖZ*

Diyabetik ayak krizi nedeni ile acil cerrahi yapılan hastaların özellikleri ve yönetimi

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AMAÇ: Diyabetik ayak krizi, diyabetik ayağın en kötü klinik tablolarından biri olarak kabul edilir. Diyabetik ayak krizinde amputasyonu önlemek ve hastanın yaşamını kurtarmak için hızla hareket etmek gerekir. Bu çalışmanın amacı, diyabetik ayak krizinin karakteristik özelliklerini ortaya çıkarmak ve sağlık profesyonellerine bu hastaları yönetme ve gerektiğinde sevk etme konusunda rehberlik etmektir.

GEREÇ VE YÖNTEM: Diyabetik ayak krizi nedeni ile değerlendirilen 65 hasta retrospektif olarak incelendi. Demografik veriler toplandı. Hastaların Infectious Diseases Society of America/ International Working Group on the Diabetic Foot (IDSAIWDGF) evreleri, Site Ischemia Neuropathy Bacterial Infection and Depth (SINBAD) ve Laboratory Risk Indicator for Necrotizing Fasciitis (LRINEC) skorları hesaplandı. Bu ölçümlere göre hastalar kategorilere ayrıldı ve istatistiksel sonuçlar elde edildi.

BULGULAR: Çalışmada, acil cerrahi müdahale gerektiren hastaların, merkezimize gelmeden önce ortalama 2 hastaneye başvurduğu ve ilk şikayet başladığından beri geçen medyan kabul süresinin 9 gün olduğu bulundu. Tüm hastaların IDSA/IWDGF evreleri 3 ve 4'tü. SINBAD skoru 4 ile 6 arasındaydı. Hesaplanan LRINEC skorlarına göre hastaların %60'ı nekrotizan fasiit açısından yüksek risk altındaydı. Periferik arteriyel tıkanıklık görülme oranı %58.2 iken hastaların %69.2'sine amputasyon yapıldı. Hastaların %21.3'ü yoğun bakım ünitesinde takip edildi.Mortalite oranı %4.2 idi.

SONUÇ: Diyabetik ayak krizi, yüksek klinik şüphe gerektiren bir acil cerrahi durumdur. Tanı konulup acil cerrahi tedavi yapılmazsa yüksek mortalite ve amputasyon oranına sahiptir. Hastaların yüksek beyaz küre sayısı, lokal ve sistemik enflamasyon bulguları, direkt grafide, alt ekstremitelerde cilt altında amfizem olması ve kan şekeri yüksekliği diyabetik ayak krizi için uyarıcı olmalıdır. Bu hastalara hızla acil cerrahi müdahale yapılmalı, hasta cerrahi için uygun bir merkezde değil ise deneyimli klinisyenlere sahip bir merkeze hızla sevk edilmelidir.

Anahtar sözcükler: Acil cerrahi; diyabetik ayak, diyabetik ayak krizi.

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