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Prevalence of Fungal Infections among Diabetic Foot Ulcers Patients in Benghazi

Ahmed S. Suwisi[1], Tarek A. Abdulkareem[2]
[1](Medical lab. Department, College of Science and Technology-Gaminis, Libya)
[2](Medical lab. Department, College of Medical Technology-Benghazi, Libya)

Abstract:
Background/aim: *Diabetes mellitus is a chronic metabolic disease having predisposing factor for fungal infections and causes significant morbidity and mortality. Mycotic infections may increase the risk of developing diabetic foot syndrome. The aim of this study is to determine the prevalence of fungal infections in diabetes foot, as well as to know the diagnostic tests for fungi that cause diabetic foot infection.*
Materials and methods: *32 samples were collected from Khalid Bin Al-Waleed Clinic. Data was collected from patients' files by the responsible medical staff, and samples were collected by sterile swabs taken from the site of the injury and examined under microscope using KOH . The data were analyzed via Excel.*
Results: *The total positive samples were 4 of 32 (12.5%). The percentage of fungal infection in males was (17.3%), and in females (0%). The infection was between the ages of 49 and 65. In this study, diabetic foot in men were about 2.5 times more numerous than women.*
Conclusion: *This study concludes that fungal infection was observed a relatively high among diabetic foot ulcers. Thus, mycological evaluation of diabetic foot ulcers is necessary in these patients. The present study results believed to have important implications for the prevention and recognition of mycotic foot disease in diabetic foot as early diagnosis is essential.*
Key words: *Prevalence, Fungal infection, Diabetic foot*

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I. Introduction

Diabetes mellitus is a chronic metabolic disease having relative or complete insulin deficiency, leading to gross defects in glucose, fat, protein metabolism. [1] Diabetes is an important predisposing factor for fungal infections and causes significant morbidity and mortality. The greater frequency of infections in diabetic patients is caused by hyperglycemic environment which atributes to defect in both cell-mediated immunity and humoral immunity. [2] The worldwide prevalence of DM has risen dramatically over the past 2 decades, from 30 million cases in 1985 to 177 million in 2000. Based on current trends, >360 million will have diabetes by the year 2030. [3] Mycotic infections may increase the risk of developing diabetic foot syndrome. However, little data are available on the prevalence of fungal foot infections in patients with diabetes. [4,5] Ulcers of the foot in diabetes are a source of major suffering and cost. Investing in a diabetic foot can be one of the most cost-effective forms of healthcare expenditure. [6] Approximately 15% of persons with diabetes will have foot ulcer in their lifetime. [7] The pathogenesis of diabetic foot is highly complex , including polyneuropathy , peripheral vascular disease, and Compromised immunity, slower wound healing, trauma and infection. [8,9] Complications associated with the development of infection and diabetic foot syndrome are the main cause of morbidity, nontraumatic lower extremity amputations, and diabetic patient mortality. [8,9] As shown by epidemiologic data, in 85% of diabetic patients foot ulcers preceded amputations of the same extremity; they also increase by as much as 20-fold the risk of minor or major amputation of the same extremity. [10,11] Bacterial infections of diabetic foot ulcers are polymicrobial and mixed aerobic- anaerobic. [8,9] While Staphylococcus spp., Streptocccus spp., Enterococcus spp., species of Enterobacteriaceae and Pseudomonas spp., are the most common aerobic isolates, Peptostreptococcus spp. And Bacteroides spp. Are the most common anaerobic isolates. [8,9] Literature data on the frequency of fungal isolation from the diabetic foot ulcer differ significantly. Candida spp. Is the most commonly isolated yeast from these ulcers (less than 5%-21%a). [12-13] This study aims to determine the prevalence of fungal infections in diabetes foot, and to know the diagnostic tests for fungi that cause diabetic foot infection.

II. Materials and Methods

Method:

Samples Collection

A total of 32 samples were collected from Khalid Bin Al Waleed clinic from 5 May 2019 to 25 May 2019 in both sexes. The number of males was 23 and the number of females was 9 cases. The ages ranged from 25-75 years.

Samples Data

Information was collected on the patients themselves, their personal files and by the medical staff responsible for the refractions. These included information (name, sex, age, type of diabetes, type of infection).

Samples Preparation

The samples were collected by sterile swabs taken from the site of the injury prior to the replacement procedure and transferred to the laboratory for direct testing KOH . See Figure no 1.

Data Analysis

The data were analyzed via the statistical program Excel .

Materials:

Microscope, Figure no 2
Slides and Cover Slides, Figure no 4
Sterile Swabs, Figure no 3
KOH Reagent, Figure no 5
Lacto Phenol Reagent, Figure no 6

Figure no 1: sample preparation

Figure no 2: Light Microscope

Figure no 3: Strile Swabs

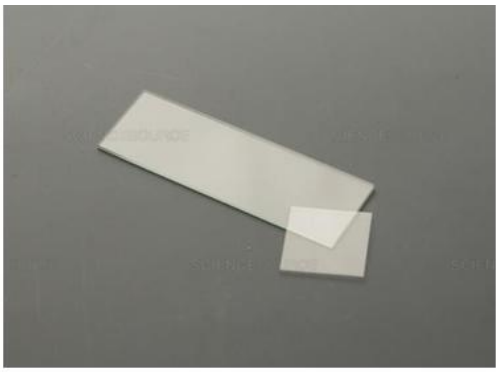

Figure no 4: Slides and Cover Slides

Figure no 5: KOH Reagent

Figure no 6: Lacto Phenol Reagent

III. Results

A total of 32 samples were collected from people with diabetic foot. Figure no 9, The number of males was 23 and the number of females was 9 from Khalid Bin Al Waleed Poly clinic as expained in figure no 7. The ages ranged from 25 to 75 years, Table no 1for more details regading age distribution of study cases.

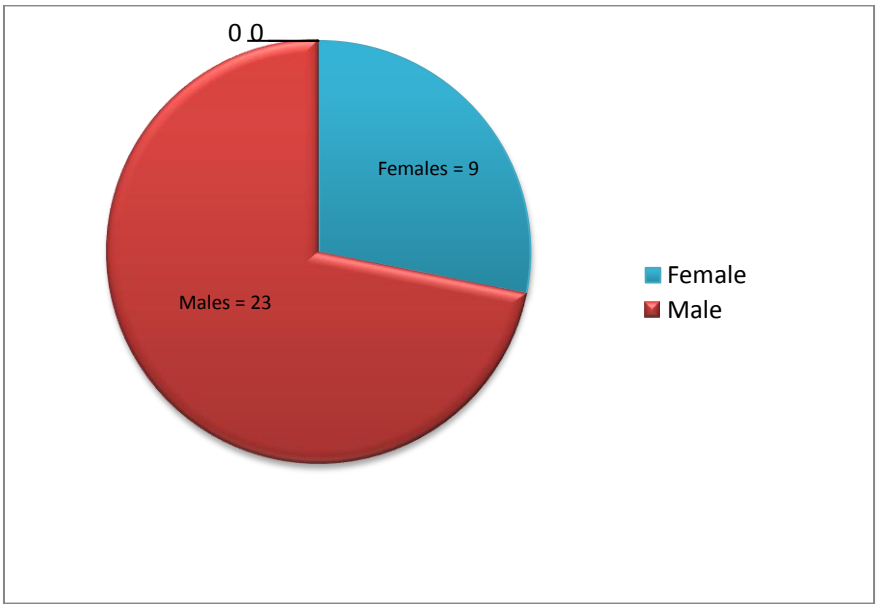

Figure no 7: The percentage of Gender distribution of total Cases

Table no 1**:** Gender, age distribution of total Cases

Age	Male %	Female %	Total %
≤40	4 (12.5%)	0	4 (12.5%)
41-50	5 (15.6%)	1 (3.12%)	6 (18.7)
51-60	6 (18.7)	4 (12.5%)	10 (31.12%)
>60	8 (25%)	4 (12.5%)	12 (37.5%)
Total	23 (71.8%)	9 (28.1)	32 (100%)

As explained in table no 1, the infection were between the ages of 49 and 65 years. 25% (n=8) of cases with diabetic foot were males >60 years old, that represented the highest cases among males, while female cases were concentrated in the age groups 51-60 and >60 making equal percentages of the toatal cases 12.5% (n=4), 12.5% (n=4).

The samples were subjected to direct examination KOH. The total positive samples of the KOH test were 4 samples of 32 samples, (12.5%) , and negative results of (87.5%) , as shown in the table no 2 . The

results showed that the percentage of Fungal infection in males was (17.3%), in samples collected from females (0%) , and this is as shown in the table no 3.

Table no 2: Mycological KOH test results from 32 diabetic patient samples

KOH test	Samples No.
Positive	4
Negative	28
Total	32

Table no 3: Fungal diabetic foot infection VS gender

Gender	Cases No.	Percentage
Male	23	17.3%
Female	9	0%
Total	32	100%

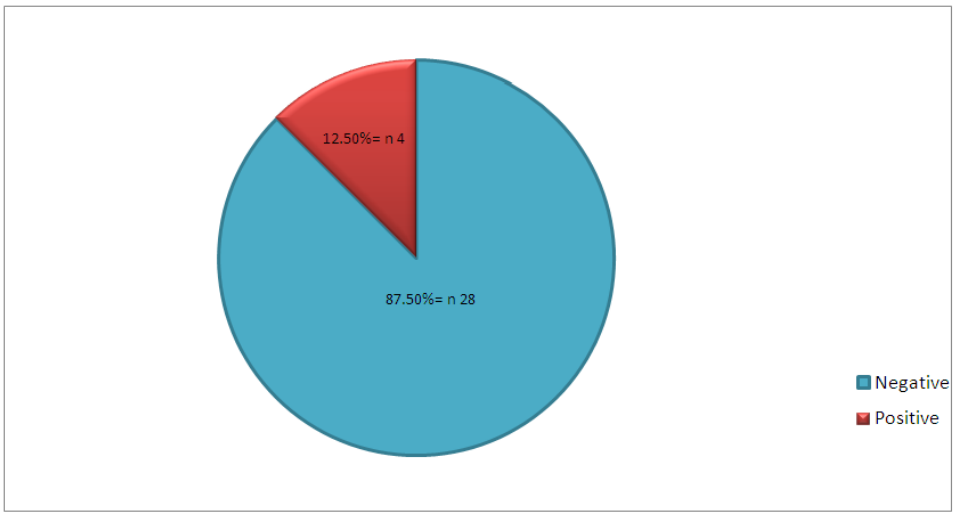

Figure no 8: Fungal infection percentage in diabetic patients included in the study

Figure no 9: People with diabetic foot

IV. Discussion

Diabetic foot is the result of uncontrolled diabetes and imperfect sanitary care which leads to necrotic lesions, gangrene and finally amputation. The risk of toe or lower leg amputation may be increased if ulceration is followed by bacterial and fungal infections. [14,15] It has already been suggested that fungal infections may be involved in the pathogenesis of diabetic foot ulcers, but this needs more investigation. [16] References on fungal infections of diabetic foot ulcers are rather rare .In this study evaluated the prevalence of fungal infection in diabetic foot ulcers. The data are supplemented by the results of questionnaire containing clinical information of the patients. The results are surprising and the patients have high level of cooperation. [17] In this study evaluated the prevalence of fungal infection in diabetic foot ulcers. The data are supplemented by the results of questionnaire containing clinical information of the patients. The results are surprising and the patients have high level of cooperation. Many studies have been done on the prevalence and spectrum of bacterial infections, the role of systemic/local antibiotics and their effect on wound healing. However, the magnitude of fungal infections in diabetic foot wounds is an area which has received very little attention. Studies have shown that toe web dermatophyte infection provides a hospitable niche for subsequent colonization by bacteria. Exacerbation of a mild dermatophyte infection (dermatophytosis simplex) can arise in the occlusive environment of the toe web space. Fungal infection induces damage to the stratum corneum, which allows overgrowth of resident bacteria and maceration, itching, and often malodor at the site. [18, 19] Similar to previous investigations[13,20], significant relationships were found between gender and age of the patients. Majority of the patients with diabetic foot ulcers were men andulcers were men andolder than 40 years and all of the fungal infections were found in men. In this study, diabetic foot in men were about 2.5 times more numerous than women, similar findings have been reported by Piérard et al. [21]

This indicates that gender-related factors affect the skin and nail structure and it may be due to differences in life style, propensity to micro traumatisms, professional activities, sport practices and etc.

In the present study is similar to the other studies by Yosipovitch et al. [19] and Sawhney et al. [22] Majority of the patients with skin lesions had uncontrolled diabetes, because uncontrolled diabetes increase the risk of development of microangiopathy and related complications or sequelae.

V. Conclusion

This study conclude that fungal infection can be observed in more than 12% of patients with diabetic foot ulcers. Thus, mycological evaluation of diabetic foot ulcers is necessary in these patients. We believe our results have important implications for the prevention and recognition of mycotic foot disease in diabetic foot and recommend that diabetic foot patients should be examined for fungal infections.

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