

Study of fungal infections in diabetic foot Ulcer

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Abstract

Introduction: Diabetes is an important predisposing factor for fungal infections and causes significant morbidity and mortality. The study was carried out for detection of fungal infections in diabetic foot ulcers.

Material and Methods: One year study was carried out on 80 patients. Samples were collected with the help of sterile swab. Direct microscopy by 10% KOH and for cultures samples were inoculated on two sets of SDA, one set incubated at room temperature and the other at 37°C. Yeasts were identified by germ-tube tests, urease test, and sugar fermentation.

Result: Out of 80 patients studied, 68.75% were male and 31.25% were female. Fungal culture positivity was seen in 17.5%. The predominant fungus isolated was *C. albicans* 42.85%, *C. tropicalis* 21.42%, *C. glabrata* 14.28%, *T. mentagrophytes* 7.14% *T. rubrum* 7.14% and *A. fumigatus* 7.14%.

Conclusion: Fungal infections in diabetic patients if not detected and treated in time leads to the fatal complications such as foot amputation.

Keywords: Diabetic foot ulcer, fungal infections, S.D.A., *Candida albicans*.

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 attributes to defect in both cell-mediated immunity and humoral immunity.⁽²⁾ Fluctuating blood sugar and hypoxia from poor circulation may impair the ability of white blood cells to destroy pathogenic bacteria and fungi increasing infection risk.⁽³⁾

India has the largest diabetic population in the world. According to WHO report, an estimated number of people with diabetes are projected to rise from 171 million in 2000 to 366 million in 2030. Bacteriological infections associated with diabetic foot ulcer are given prime importance. The mycology of the lesions was not given equal importance in the past when compared to its bacterial aspects due to lack of literature. The study was carried out to detect the fungal infections for quick diagnosis and immediate treatment to prevent the further complications.

Material and Methods

The study was carried out in the Department of Microbiology for a period of one year from June 2015 to May 2016. The total number of cases studied were 80. The inclusion criteria for the study was a known diabetic patient with history of at least five years with foot ulcer of grade 1 or more. Meggit Wagner Classification System categorized the diabetic foot ulcer into six grades (grade 0 to grade 5). The exclusion criteria was all the patients with grade 0, already treated

with anti-fungal therapy, chemotherapy, immunosuppressant, patients with skin grafting on the feet.

The sample was collected with the help of sterile swab from the depth of the wound. Direct microscopic examination was carried out using 10% potassium hydroxide (KOH). For the isolation of both moulds and yeasts, the sample was inoculated on two sets of Sabouraud's dextrose agar slants with chloramphenicol. One slant was incubated at room temperature and other at 37°C for one month. The media were observed for growth daily for the first week and twice a week for the subsequent period. Further the culture was identified by macroscopic and microscopic morphology such as lactophenol cotton blue, slide culture. Further for isolation of *Candida*, growth from Sabouraud's dextrose agar inoculated onto corn-meal agar, CROM agar and identified by germ tube formation, urease test, sugar fermentation.

Result

Among the 80 patients studied 55 (68.75%) were males and 25 (31.25%) were females shown in Table 1. The age of patients ranged between 32-73 years. From the 80 patients, 14 (17.5%) had positive fungal culture, 9 (64.28%) were males and 5 (35.71%) were females shown in Table 2. From 14, 11 (78.57%) were yeasts, the predominant yeast isolated was *Candida albicans* 6 (42.85%), followed by *Candida tropicalis* 3 (21.42%), *Candida glabrata* 2 (14.28%) and from 14, 2 (14.28%) were dermatophytes and 1 (7.14%) was mould *Aspergillus fumigatus*. The dermatophytes isolated were, *Trichophyton mentagrophyte* 1 (7.14%) and *Trichophyton rubrum* 1 (7.14%) as shown in Table 3. Negative fungal cultures were seen in 66 (82.5%).

Among the 80 patients 68 (85%) had type II mellitus and 12 (15%) had type I diabetes mellitus.

Table 1: Sex distribution of total Cases

Total Cases	Male (%)	Female (%)
80	55(68.75%)	25(31.25%)

Table 2: Sex - wise distribution of fungal positive cultures

Total fungal positive cultures (%)	Male (%)	Female (%)
14 (17.5%)	9 (64.28%)	5 (35.71%)

Table 3: Fungi isolated in Diabetic foot ulcer

Fungi isolated	Number (%)
<i>Candida albicans</i>	6 (42.85%)
<i>Candida tropicalis</i>	3 (21.42%)
<i>Candida glabrata</i>	2 (14.28%)
<i>Trichophyton mentagrophytes</i>	1 (7.14%)
<i>Trichophyton rubrum</i>	1 (7.14%)
<i>Aspergillus fumigates</i>	1 (7.14%)
Total	14 (100%)

Discussion

Diabetic foot ulcer is one of the most serious complications of diabetes. In comparison to otherwise healthy individuals, people with diabetes are at an increased risk of developing fungal infections and more likely to face complication such as bacterial infection, foot ulcer, lower-limb amputation. But the references on fungal infection of diabetic foot ulcers are rare, so the study was carried out to detect the prevalence of fungal infection in diabetic foot ulcer and for comparison of our study findings with previous study.

In our study, majority of patients with diabetic foot ulcers were male, similar results were seen in.⁽⁵⁻⁸⁾ The total fungal positive cultures seen in our study were 17.5%, similar findings were seen in.^(9,10)

In our study, *Candida* species were most frequently isolated, the predominant was the *Candida albicans* 42.85% similar results were seen in.^(11,12) But the predominance of *Candida tropicalis* was shown by⁽¹³⁻¹⁵⁾ In our study other species of *Candida* isolated were *Candida tropicalis* 21.42% and *Candida glabrata* 14.28%, other studies reported⁽¹³⁻¹⁶⁾ *Candida parapsilosis*, *Candida guilliermondi*, *Candida tropicalis*, *Candida glabrata*, *Candida fumata*, *Candida kefur*.

In the present study, dermatophyte isolated were *T. mentagrophytes* 7.14% and *T. rubrum* 7.14% but in some studies⁽¹⁶⁾ dermatophyte was the predominant fungi isolated accounting for 69.2% and similar findings found in.⁽¹⁷⁾

In our study, mould isolated was *A. fumigatus* 7.14% but some studies were showing the isolation of *A. flavus* and *F.solani*^(18,19) and in some^(12,16,20) showing

the isolation of *Aspergillus*, *Scopulariopsis*, *Fusarium*, *Penicillium*.

Conclusion

Due to hyperglycemic environment and suppressed immunity, diabetic patients are more prone to infections. Fungal infections in diabetic patients if not treated in-time leads to the fatal complications such as foot amputation.

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