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A Cross Sectional study on prevalence of fungal infections in Diabetic foot ulcer

KEYWORDS: Diabetic foot ulcer, Fungal infection, Culture and sensitivity, Antifungal.

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ABSTRACT **Background:** Prevalence of diabetes mellitus is being increasing globally as well in India. India has become the diabetic capital of the world. Fungal infections are often common in diabetes mellitus. Diabetic lower limb wounds account for one of the commonest forms of complications with diabetes. These ulcerated lesions are easily susceptible to infections. Several studies have concluded the presence of varied microbial flora associated with the wounds. The mycology of the lesion is not given equal importance when compared to its bacterial aspect. **Objectives:** This study was done in an attempt to study the prevalence and spectrum of fungal infection in diabetic foot ulcers. **Materials and Methods:** This was a hospital based cross sectional study conducted over a period of 6 months. A total number of 120 patients with diabetic foot ulcers were included in this study. Patients already treated with anti-fungal therapy, chemotherapy, immunosuppressant, radiotherapy and corticosteroids were excluded. Detailed history of all patients was taken. These patients were evaluated with reference to clinical symptomatology and biochemical profile for diabetes mellitus. Two tissue samples, which were taken from the bed of the diabetic foot ulcer from each patient, one was sent for microscopic examination and the other for culture sensitivity both bacterial and fungal. The patients were treated with regular dressing and antifungal therapy in addition to appropriate antibiotics as per bacterial culture sensitivity. **Results and Observations:** Out of the 120 patients, evaluated 20% had positive fungal cultures, among them most common fungal strain was C albicans and secondly was C tropicalis. **Conclusion:** Management of diabetic foot ulcers must include antifungal antibiotics as per fungal culture sensitivity report in addition to routine bacterial culture sensitivity and other modalities.

Introduction:

Diabetes mellitus is the most common metabolic disorder and it is rising to pandemic proportions. The most devastating chronic complication of diabetes is diabetic foot. The hallmark of Indian diabetic foot is severely infected foot. Such patients have life threatening infection and therefore invariably require primary limb amputation[1].

The microbiology associated with diabetic foot ulcers studied from samples taken from deep tissue bed is varied. In addition, several studied have shown the researched evidence of presence of both aerobic and anaerobic bacteria associated with the infections. Even though bacteriological infections associated with diabetic foot ulcers are given prime importance, the opportunistic fungal infections are ignored. The mycology of the lesion was not given equal importance in the past when compared to its bacterial aspect due to lack of literature. However, re cent studies have shown the presence of wide range of fungal strains in an infected foot ulcer of a diabetic patient, with Candida species accounting for the most commonly isolated strain. Ideal treatment of an infected diabetes foot ulcer should encompass all the possible microbiological causes, to provide efficient and specific treatment to the surgical patient[2].

Aim and Objectives:

1. To study the prevalence of fungal infection in diabetic foot ulcers.
2. To study the spectrum of fungal strains isolated from the wounds.

Material and Methods:

This was a hospital based prospective cross sectional study which was carried out in a tertiary care hospital of Chattisgarh during period of January 2016 to June 2016 (ie.6 months). A total number of 120 cases were studied. The study was carried out after obtaining clearance from institutional ethics committee. All patients with diabetic foot ulcers coming to our hospital were included in this study. Patients already treated with anti-fungal therapy, chemotherapy, immunosuppressants, radiotherapy and corticosteroids were excluded.

After duly obtaining an informed consent, detailed history of all patients was taken. These patients were evaluated with reference to clinical symptomotology, biochemical profile for diabetes mellitus (FBS, PPBS and HbA1C) .Two tissue samples which were taken from the bed of the diabetic foot ulcer from each patient is put in a sterile container containing normal saline and is sent to the microbiology laboratory and Microscopic examination of collected tissues were done. One of the tissue bit is soaked in 10% KOH, the other tissue bit is used for fungal culture sensitivity with Sabourauds dextrose agar supplemented with chloramphenicol and cycloheximide, incubated at 30°C and 37°C for 4 weeks. The patients were treated with regular dressing, appropriate antibiotics according to bacterial culture sensitivity till the fungal culture reports. Antifungal therapy was started as per the culture sensitivity report.

Results and Observations:

A total of 120 diabetic subjects were involved in the study. They comprised of 45 females (37.5%) and 75 males (62.5%). 30 subjects were 40 years and below, 50 (41.6%) were within the 41-60 years age range while 40 (33.3%) were more than 60 years old.

The duration of diabetes was equal to or less than 5 years in 5 (4.16%) subjects, 90 (75%) subjects had it for a period of between 6 - 10 years while only 25 (20.8%) had been diabetic for more than 10 years. 110 (91.7%) subjects had type 2 diabetes and only 10 (8.3%) had type 1 diabetes.

The body mass index (BMI) was above the normal range in 100 (83.3%) subjects; normal in 10 (8.3%) subjects and below normal in 10 subjects **(Table 1).**

Characteristics	Frequency (f)	Percent (%)
Gender		
Male	75	62.5
Female	45	37.5
Total	120	100
Age		
≤20 years	05	4.16
21-40 years	25	20.8
41-60 years	50	41.6
>60 years	40	33.3
Total	120	100
Occupation		
Unemployed	40	33.3

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Government job	10	8.3
Private job	10	8.3
Farmer or others	60	50
Total	120	100
Type of Diabetes Mellitus		
Type 1	10	8.3
Type 2	110	91.7
Total	120	100
Duration of Diabetes		
≤5 years	05	4.16
6-10 years	90	75
>10 years	25	20.8
Total	120	100
BMI (Kg/m2)		
<18.5	10	8.3
18.5-24.9	10	8.3
25-29.9	35	29.17
>30	65	54.17
Total	120	100

Table 1: Socio demographic distribution of patients

Among the 120 patients, 24 had positive fungal cultures-20 males and 4 females **(Table 3)**. Among the 24 fungal cultures, Candida species of fungal isolates were predominant; specifically strains of *Candida albicans*-18 samples and *Candida tropicalis*-6 samples **(Table 2).**

Predominant fungal strain	No. (%)
Candida Albicans	18 (15%)
Candida Tropicalis	06 (5%)

Table 2: Types of fungal strains isolated

Sex	Total no of positive fungal cultures
Male	20
Female	04

Table 3: Sex distribution of positive fungal cultures

Discussion:

Approximately a quarter of all people with diabetes will develop sores or ulcers at some point during their lifetime[3].

Diabetic foot ulcers (DFU) are one of the most dreaded and common complications of diabetes, which is associated with lower limb amputation and account for majority of non-traumatic amputations conducted4. This is also associated with high morbidity and substantial health care costs[5].

Aetiology though being multi factorial, peripheral neuropathy and ischemia are the major factors for DFU along with several other contributing risk factors[6].

The duration of diabetes plays an important role in the formation of ulcer and the incidence of lower extremity amputation was more in patients who have diabetes for more than 5 years. Longer the duration of diabetes, higher are the chances of developing a non-healing ulcer. Mehamud et al7 reported that out of 120 patients, majority of patients who underwent amputation had diabetes more than 10 years ($p<0.05$). Among our patients, 4.16% had diabetes for less than 5 years, 75% of them had from 5 to 10 years, and 20.8% had for more than 10 years.

In our study, of all the 120 samples sent for microbiological examination only 24 (20%) samples were found to be positive for fungal strains, which are lower than a similar study, which was conducted in India by *Chellan et al*[8], which reported positive Fungal isolates in 27.2% of the total number of samples.

The same study reported that the most predominant fungal species, which was isolated, was found to be Candida species, which coincides with our study.

The most common Candida species was found to be *C albicans* (88.8%) followed by *C tropicalis* (11.11%) of the total fungal isolates substantiated by a study conducted by Nair S et al9 to assess the incidence of mycotic pathogens in diabetic foot ulcers.

In a study by Chincholikar et al[10], swabs were collected from 105 diabetic foot ulcer patients, which revealed that the fungal isolates accounted for 20.8%. Among this yeasts were predominant accounting for 94.55% and moulds comprised 5.46%. *Candida tropicalis* (54.55%) were most common followed by *candida albicans* (12.73%) among the yeasts.

A study by Bansal et al[11] in government medical college and hospital, Chandigarh demonstrated polymicrobial infection in 35% of the patients. In this, *Pseudomonas aeruginosa* (22%) and *Staphylococcus aureus* (19%) were predominantly isolated. Among fungal isolates candida species were most predominantly isolated.

Conclusion:

Management of diabetic foot ulcers must include antifungal antibiotics as per fungal culture sensitivity report in addition to routine bacterial culture sensitivity and other modalities.

Limitations of study:

This study may not reflect all the aspects of management of diabetic foot ulcers, further, the study was among a small group of 120 patients in a short period.

A larger study spanning over longer period and a bigger sample size is required to draw definitive conclusions.

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