

Original Research Article

Clinical pattern of superficial mycosis in rural type 2 diabetes mellitus patients

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ABSTRACT

Background: Diabetic foot infections are a major cause of amputations and mortality. There is heterogeneity in type of superficial fungal infections because of change in climatic conditions and lifestyles across world. There is paucity of reports on etiology of superficial fungal infections in rural type 2 diabetes mellitus patients in India, so the present study was undertaken to find out the clinical pattern of superficial fungal infections in rural type 2 diabetes mellitus patients.

Methods: Rural type 2 diabetes mellitus patients clinically diagnosed to have superficial fungal infection were enrolled and were subjected to direct microscopy in KOH stain and fungal culture.

Results: 100 type 2 diabetes mellitus patients were enrolled (58 males and 42 females). 45 were either KOH or culture positive. 73.1% were dermatophytes and rest nondermatophytes. *Trichophyton rubrum* was the commonest (48.8%) dermatophyte.

Conclusions: *Trichophyton rubrum* was the commonest dermatophyte causing superficial infection. Besides dermatophytes non-dermatophytic fungi are also emerging as important cause of superficial mycosis.

Keywords: Diabetes Mellitus, Dermatophytes, KOH stain, Rural

INTRODUCTION

The prevalence of diabetes in adults aged 20-79 years was estimated to be 8.8% in 2015 and predicted to rise to 10.4% in 2040.¹ Of 371 million diabetic people worldwide 63 million are Indian.² Patients with diabetes represent a unique group of individuals who appear more prone to develop infections than others. One of these problems is the fungal infections of skin and nails that account for a higher frequency in diabetic patients. These fungal infections, in turn, can result in the increase frequency of diabetic foot.^{3,4} Diabetic foot infections frequently result in morbidity, hospitalization and amputations therefore, the determination of its aetiology,

timely diagnosis and treatment can help to prevent the serious drawbacks in these patients.⁵ The fungal infections of the skin and its appendages are more common in tropical countries like India due to environmental factors like heat and humidity. The risk factors include socio-economic conditions like overcrowding, poverty and poor personal hygiene.⁶ There are reports on intracontinental variability of the superficial fungal infections because of the change in climatic condition across the world.⁷ This heterogeneity in the prevalence and type of superficial fungal infections in different parts of the world has been attributed to factors such as climate (humidity, temperature), lifestyle, involvement in outdoor activities. Another factor is the

reluctance of patients to seek treatment because of the minor nature of the disease. As there is paucity of reports on aetiology of superficial fungal infections in rural type 2 diabetes mellitus patients in India so the present study was undertaken to find out the clinical pattern of superficial fungal infections in rural type 2 diabetes mellitus patients.

METHODS

The present study was conducted in department of medicine, in Era's Lucknow Medical College, which caters to the population of Lucknow and its surrounding districts. Study subjects included were from rural areas of Lucknow and its surrounding districts. It was a cross-sectional study and data was collected for 1 year between June 2016 to June 2017. Written and informed consent was taken for participating in the study from the subjects.

Study subjects included were consecutive rural type 2 diabetes mellitus patients clinically diagnosed to have superficial fungal infection coming in medicine OPD. Diabetes mellitus was diagnosed according to ADA criteria.⁸ Subjects having any end stage organ disease, chronic liver disease, chronic renal failure, chronic respiratory insufficiency, malignancy, HIV, hepatitis B, hepatitis C positive and on steroids therapy were excluded from the study. All these patients were subjected to detailed history, systemic examination, dermatological examination and investigations. A pre-designed proforma including age, sex, duration of diabetes, history of previous drug therapy, control of diabetes, type of lesion, distribution of skin lesion, involvement of toe-web, nails, soles, mouth and vagina (in females patients) was administered to patients for data collection subjects suspected for superficial fungal infection were subjected to blood sugar fasting and post prandial, Hb1Ac, serum cholesterol, direct microscopy in 10% potassium hydroxide (KOH) for skin samples and 40% KOH for nail samples.

The samples were cultured in Sabourauds dextrose agar tubes into two sets, one group with chloramphenicol and other with cycloheximide (to prevent growth with saprophytic fungi and bacteria); and incubated at 37 and 25°C; respectively. The cultures were examined for presence of growth, colony morphology, and pigment production. Slide cultures were prepared for identification of specific fungal species.

RESULTS

A total of 300 patients were screened out of which 100 patients were clinically diagnosed to have superficial fungal infection. Baseline characteristics of all subjects are expressed as mean \pm standard deviation and range (minimum and maximum) in Table 1. Out of these 100 patients 58 were males and 42 females. Mean age was 50 ± 6.5 SD years. Mean duration of diabetes was 10 ± 1.6 SD years. Mean fasting and postprandial blood

sugar was 150 ± 11.35 and 185.49 ± 15.32 SDmg% respectively. Mean Hb1Ac was 7.68 ± 0.20 SD%. 19 patients were only on insulin and 81 were on oral hypoglycaemic drugs. Superficial fungal infections involved skin of trunk, gluteal region, proximal leg or arm, and chest (56%), groin (13%), nails (10%), soles and toe webs (10%) (Table 2).

Table 1: Baseline characteristics of study subjects.

Baseline characteristics	Mean \pm SD	Range (Min-Max)
Age (Years)	50.77 \pm 6.50	35-65
Duration of diabetes (years)	10 \pm 1.60	6-14
BMI (kg/m ²)	24.24 \pm 2.60	18-29
SBP (mmHg)	130.64 \pm 3.86	124-142
DBP (mmHg)	87.15 \pm 3.94	76-94
Fasting plasma glucose (mg/dl)	150 \pm 11.35	90-170
2 h plasma glucose (mg/dl)	185.49 \pm 15.32	151-209
HbA1c (%)	7.68 \pm 0.20	6.5-8.0
Total cholesterol (mg/dl)	180.36 \pm 14.09	155-225

Table 2: Distribution of superficial fungal infection according to the site (Total N=100).

Site	No. (%)
Skin (trunk, gluteal, proximal leg or arm, chest)	56 (56)
Hands	5 (5)
Feet (toe webs, soles)	10 (10)
Scalp	6 (6)
Nails	10 (10)
Groin	13 (13)

Table 3: Proportion of SFFI with FBS and PPBS levels (N=45).

Parameters	(N=45)
Fasting blood sugar (mg/dl)	
<100	2
100 -125	5
\geq 126	38
Post prandial blood sugar (mg/dl)	
<140	3
140-199	35
\geq 200	7

Table 4: Distribution of isolated fungal species (Total N=45).

Species	No.	%
<i>Trichophyton rubrum</i>	22	48.8
<i>Trichophyton mentagrophytes</i>	6	13.3
<i>Microsporum canis</i>	3	6.6
<i>Microsporum gypseum</i>	2	4.4
<i>Candida species</i>	10	22.2
<i>Aspergillus species</i>	2	4.4

A 45 out of 100 patients were either KOH or culture positive. Out of 45 patients M:F ratio was 2:1 (30 males and 15 females). 5 patients were between 35-44 years, 30 between 45-54 years, 10 between 55-65 years. Maximum patients were in 45-54-year age group. Superficial fungal infection increased with the duration of diabetes (22 > 10 years, 18 between 5-10-years and 5 < 5 years). Superficial fungal infections were more in uncontrolled fasting and postprandial blood sugar group (Table 3). Out of 45 organisms which were isolated 33 (73.3%) were dermatophytes and 12 (26.6%) were nondermatophytes. Among dermatophytes *Trichophyton rubrum* was the commonest (48.8%), followed by *Trichophyton mentagrophytes* (13.3%), *Microsporum canis* (6.6%), *Microsporum gypseum* (3.3%). Among the non dermatophytes *Candida species* was commonest (22.2%) followed by *Aspergillus species* (4.4%) and the most common site of infection by non dermatophytes was nails (Table 4).

DISCUSSION

Foot infections are a major cause of morbidity in people with diabetes. A broader range of etiological agents from primary pathogens to opportunistic fungal species is one of the characteristic of fungal infections combined with diabetes. The clinical presentations of fungal infections are unpredictable and poor, often leading to delayed diagnosis.⁹ Our study assessed the clinical pattern of superficial fungal infections in rural type 2 diabetes mellitus patients at a tertiary care hospital in Northern India.

There has been contrasting results for gender predominance in previous studies. Both male predominance and no difference between the gender for risk of superficial fungal infections has been reported.^{10,11} Our study showed a M:F ratio of 2:1 in KOH or culture positive patients possibly because in rural areas males are much more exposed to shoe trauma and perspiration than females. In our study, most culture confirmed cases were in the age group of 45-54 years possibly because this age group has maximal outside activity. In this study, duration of diabetes was longer and fasting and postprandial blood sugar was more in patients with superficial fungal infections which was similar to previous studies.^{10,12} Previous study of Delamaire et al, has shown that the elevated sugar levels in blood, decreases the granulocyte function, leading to tissue invasiveness and enhanced growth of superficial fungi in diabetic foot.¹³

Most common site was skin of trunk, gluteal region, proximal leg or arm, and chest which is similar to findings observed in the study by Mishra et al.¹⁴ Dermatophytes is the commonest isolate causing superficial fungal infection, and in that *Trichophyton rubrum* is the commonest species. A previous study done in Sri Lanka also showed *Trichophyton rubrum* as the most prevalent causative agent for superficial fungal

infections.¹⁵ In our study, the percentage of non-dermatophytic fungus isolated was 26.6%. The commonest non-dermatophyte isolated was *Candida*, followed by *Aspergillus*. In a study by Grover et al, the percentage of non-dermatophytes was 34%.¹⁶ In another study Nair et al showed that *Candida albicans* was the most common fungal pathogen isolated from nails.¹⁷ In contrast to our study, Gupta et al and Romano et al, have reported that dermatophyte fungal species such as *Trichophyton species*, *Microsporum species* and *Epidermophyton spp.* were more common in toe nail infections in diabetic foot.^{18,19} This conflicting data may be because of the climatic factors in different geographical areas in the world and differences in habits, cultures among different nations and also may be due to the emerging pathogens. Non-dermatophytes are now being increasingly reported to cause infection of nail. Due to less prominent symptoms superficial fungal infections are being less reported to doctors. Hence examining feet for fungal infections among diabetic patients is important because it might lead to development of severe secondary bacterial infection in diabetic foot. Therefore, education of diabetic patients regarding appropriate foot hygiene and the need of daily self-inspection of the feet in order to detect and manage the infections in lower limbs is important. Identification of species is vital to curtail the drug resistance among the fungus.

CONCLUSION

This study shows that superficial fungal infections were seen significantly with the increasing age, male gender, duration of the diabetes and with less controlled glycaemic level in rural type 2 diabetes mellitus patients. *Trichophyton rubrum* is the commonest dermatophyte causing superficial infection. Besides dermatophytes non-dermatophytic fungi are also emerging as important cause of superficial mycosis, where *candidiasis* is the commonest species of non-dermatophytes affecting nails. Regular examination and appropriate treatment is recommended in-order to minimize the possible complications associated with fungal infections.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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