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Clinical and Mycological Study of the Macerated Toe Web in Egypt

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Introduction

Maceration of the toe web is one of the most common dermatologic conditions met with in clinical practice. It presents itself in several ways as itching, fissuring, pain, foetid odour; or it may be symptomless and is only discovered during routine examination. Regardless of the mode of presentation, the condition is often clinically diagnosed as "Interdigital Tinea Pedis" (ITP) and the conventional antifungal treatment is prescribed.

Following the introduction of griseofulvin in clinical practice it was hoped that a good deal of the problem would be solved. Unfortunately, the results with griseofulvin therapy in tinea pedis — despite prolonged courses — were disappointing. It was also the impression of most Egyptian dermatologists, that griseofulvin was not the drug of choice in interdigital tinea pedis.

Various species of dermatophytes as T. rubrum, T. interdigitale, E. floccosum are usually mentioned in the medical literature as the most common causes of tinea pedis (Lewis et al., 1958; Pardo-Castello and Trespalacios, 1959; Neves, 1960; English et al., 1967; English and Turvey, 1968) and these are well known for their sensitivity to griseofulvin. Therefore, we thought that it would be rather necessary to investigate the problem of tinea pedis in our country and try to isolate the causative organisms and find out whether they are either resistant strains of dermatophytes or totally different organisms.

Material and Methods

1. *Pilot study of the magnitude of the problem:*

The feet of a random sample of patients attending the outpatient clinic at Ain Shams University Hosiptals over two one-month periods (January and August 1969) were examined for what is often diagnosed as "interdigital tinea pedis". The sample consisted of 448 persons, 174 males and 274 females, who were coming for complaints of various natures.

2. *Selection of patients for mycologic study:*

All patients referred to the mycology laboratory at Ain Shams University Hospitals because of interdigital tinea pedis were examined. Full clinical history was taken with particular stress on the factors known to predispose to the condition such as the type of foot wear, exposure to water, hyperhidrosis .... etc. The cases examined were divided into 4 groups as follows:

Group A: interdigital spaces showing mild erythema and scaling;

Group B: interdigital spaces covered with hyperkeratotic white sodden lesion on a red macerated base;

Group C: vesicles are seen in addition to erythema;

Group D: cases showing dry hyperkeratosis of the toe web spaces.

Scrapings from the affected webs were collected and examined microscopically by KOH preparations and inoculated on Sabouraud dextrose agar to which cycloheximide and chloramphenicol were added. Cultures yielding yeast colonies were further identified using sugar fermentation reactions and sugar assimilation tests (Rieth and Schoenfeld, 1959). The dermatophytes were identified according to their macro- and microscopic structures as well as their nutritional requirements.

Results

1. *Magnitude of the problem:*

A total of 146 persons of both sexes were found to have maceration of one or more of the two webs and this constitutes 32.5 % of the total number examined (448). Of 174 males, 54 had interdigital maceration (31.1 %); and of 274 females 92 were affected (33.6 %).

2. *Mycologic study:*

304 cases have been investigated in the present series, 215 were females, and the remaining 89 were males. The direct microscopic examination was positive in 112 cases showing filaments or budding cells.

Cultures yielded yeast colonies in 196 cases (64.4 %), dermatophytes in 14 cases (4.6 %), moulds in 32 cases (10.5 %), and there was no growth in 62 cases (20.4 %). The moulds were considered as contaminants and were not taken into consideration.

Analyses of the results are summarised in the following tables:

Table I: Incidence according to age

Age years	Genus Candida	Dermato-phytes	Moulds	No growth	Total
1—10	2	1	—	—	3
11—20	70	1	10	18	99
21—30	60	6	8	16	90
31—40	34	4	8	14	60
41—50	22	2	4	12	40
Above 50	8	—	2	2	12
Total	196	14	32	62	304

Table II: Sex incidence

Sex	Genus Candida	Dermato-phytes	Moulds	No growth	Total
Females	160 (74.4 %)	3 (1.4 %)	24 (11.2 %)	28 (13 %)	215
Males	36 (40.5 %)	11 (12.4 %)	8 (9 %)	34 (38.2 %)	89

N. B. Percentage is related to the total number of the same sex.

Table III: Fungi isolated from different clinical varieties

Variety	Genus Candida	Dermato-phytes	Moulds	No growth	Total
Group A	38	10	8	30	86
Group B	152	2	20	30	204
Group C	4	—	—	—	4
Group D	2	2	4	2	10
Total	196	14	32	62	304

Table IV: Extent of the lesions

	Genus Candida	Dermato-phytes	Moulds	No growth	Total
Bilateral	138	2	18	32	190
Unilateral	58	12	14	30	114
One space	57	6	12	24	99
Two spaces	87	8	18	28	141
Three spaces	52	—	2	10	64
Four spaces	—	—	—	—	—

Table V: Fungal Flora isolated

Genus Candida	196
C. albicans	164
C. tropicalis	4
C. stellatoidea	2
C. catenulata	2
Unidentified	24
Dermatophytes	
T. rubrum	12
T. mentagrophytes	2

Discussion

The pilot study carried out in this work shows that 32.5 % of individuals attending Ain Shams University Hospitals were suffering from maceration of the toe webs. One cannot consider this percentage as the true incidence of the condition among the population at large in our country, yet it gives a rough idea about the magnitude of the problem. HILDICK-SMITH et al. (1964) stated that, various statistics based on studies carried out in schools, institutions, and armed forces suggest that between 30 and 70 % of the population have at sometime in their lives a fungus infection of their feet. Thus the relatively high incidence of involvement of toe webs in our series is not surprising.

There was no statistically significant difference between the incidence of the condition in patients examined during winter or summer seasons. This can be explained by the fact that during winter, persons wear socks and shoes more frequently than in summer where sandals are used more often. This compensates for the increased sweating in summer time.

Maceration of toe webs is a disease of active age groups. It can be shown from **table 1** that the highest incidence is in the third and fourth decades, being minimal below 10 years and less frequent above 50. The possibility of creation of factors which facilitate fungus infection is more with active than with sedentary life. Mere contact of skin with fungal elements is not sufficient to produce clinical infection, but if these find a break in the defence mechanism of the skin such as trauma or maceration they will readily localize (Baer et al., 1955; Baer, and Rosenthal, 1966). Activity and work entail more walking, washing and sweating thus facilitating friction, trauma and hydration of the stratum corneum, factors well known to invite skin infection.

The proportion of females referred to the mycology laboratory for investigation far exceeded that of males, the difference between the two sexes however, was slight in the random sample. This could be explained by the fact that females usually seek medical advice more often than males.

It is usually mentioned in the literature that tinea pedis is more common in males than in females (Ormsby and Montgomery, 1954; Hildick-Smith, Blank, and Sarkany, 1964; Baer and Rosenthal, 1966). In our series, however, the difference between the two sexes was not marked and it could be considered that both sexes are equally affected or with slight predominance in females.

Baer and Rosenthal (1966) conducted an experiment in which they tried to produce experimental fungus infection of feet, and they concluded that when the conditions of exposure to infection are standardized, both men and women have the same susceptibility to infection. This finding suggests that it is not a basic inherent difference in susceptibility which accounts for the clinically observed difference between men and women, but it is a difference in the way of exposure to the predisposing factors.

Yeasts belonging to the genus Candida constituted the most common organisms isolated in the present series (64.4 %), Candida albicans was by far the most common (53.9 %). Dermatophytes on the other hand constituted only 4.6 % in our series, such finding is rather surprising especially when compared with reports in the medical literature where C. albicans was responsible for less than 5 % of cases of tinea pedis (Lewis et al., 1958; Pardo-Castello and Trespalacios, 1959).

An important question will now arise; is the isolated Candida a saprophyte, a secondary invader, or the actual causative agent of the condition? By speculation it is possible that the condition may have started as a true fungus infection of the toe webs rendering the site ready for secondary invasion by yeast organisms, and the latter may prevent the growth of dermatophytes through a process of antibiosis. We failed to find such a finding of antibiotism between yeasts and dermatophytes in the available literature, however the idea is worth varification.

Candidal saprophytism on normal skin is extremely rare (Schirren, 1963; Winner and Hurley, 1964). Kozinn and Taschdjian (1966) were able to isolate C. albicans in only 0.4 % of cultures done from normal skin. Maibach and Kligman (1962) stated that C. albicans occur on skin predominantly as the aetiologic agent of primary lesions. It is rarely, if ever, found in lesions of other aetiologies. Consequently, the possibility that the isolated C. albicans represents a secondary invader or a saprophyte can be ruled out.

Candidal organisms including C. albicans are facultative pathogens whose invasive potential varies with the number in which they are present on skin as well as by certain factors that may affect the host resistance. Hydration of stratum corneum is probably the most important single factor in this respect. Maibach and Kligman (1962) failed to produce experimental candidal infection of skin — inspite of the large number of organisms applied — unless the stratum corneum was perfectly hydrated by tight occlusion.

Most of the cases from which Candida were isolated gave a history of exposure to one or more of the factors that favour hydration of stratum corneum of toe webs. They were either housewives whose home work necessitated exposure of feet to water, or Moslems who pray regularly. Washing of face, forearms, head, ears and feet is a prerequisite for praying which is repeated five times a day. Frequent washing of feet followed by wearing socks and shoes greatly enhance hydration of stratum corneum of toe webs, particularly narrow web spaces which tend to retain water longer and cannot be dried completely.

It has been shown that water soluble substances extracted by shaking powdered callus in water provided without supplementation a nutrient milieu highly favourable to C. albicans (MAIBACH and KLIGMAN, 1962). It is possible then that, continuous hydration of the thick corneum of feet dissolves water soluble materials which constitute 20 % of the weight of the horny layer (FLESCH, 1958) thus providing a good amount of nutrients helping localization and multiplication of Candida. Frequent washing not only provides easy nourishment for organisms, but also removes the protective fatty film. KÄRCHER (1956) found that prior defattening of skin with ether greatly exacerbated candidal infection.

Trauma is another important factor which helps localization of fungus in skin. BAER and ROSENTHAL (1966) demonstrated that blistering trauma is a prerequisite of a successful take in experimental dermatophytic infection. RAUBITSCHECK (1946) could produce typical erosio interdigitalis in the dorsal web of the fingers by scarification of the skin without hydration. The role of trauma as a predisposing factor explains prevailance of candidal infection in the third and fourth web spaces which are liable to friction trauma during activity.

MOURAD and FRIEDMAN (1961) showed that the pathogenicity of C. albicans varies with individual strains. It seems that the strain prevalent in Egypt has an increased virulence towards human skin since it constitutes not only the main pathogenic organism of the macerated toe webs, but also the most common causative agent of onychomycosis in Egypt (ABDEL-FATTAH et al., 1969).

We prefer to call the condition "The macerated Toe Web" instead of interdigital tinea pedis since white maceration, erosion and fissuring of toe webs may be caused by various unrelated organisms. The gross clinical picture is nearly the same and laboratory investigations are the only possible means for final diagnosis.

In addition to yeasts and dermatophytes, bacteria as diphteroids, pseudomonas, micrococcus and mima can produce maceration of toe webs (KINGERY, 1965; HILDICK-SMITH, et al., 1964). It is possible that some of the cases of our series which yielded no fungal growth belong to this group.

The fact that organisms belonging to the genus Candida constitute the major causative agent of macerated toe web in Egypt explains the disappointing results with griseofulvin therapy and should always be born in mind before prescribing treatment.

Summary

A random sample of 448 patients attending the outpatient clinic at Ain Shams University Hospitals were clinically examined for fungus infection of the toe web. 32 % were found to have maceration of toe webs. Sex difference was not significant. 304 Cases were submitted for mycological investigation in our laboratory. Yeasts of the genus Candida were isolated from 64.4 %, dermatophytes in 4.6 % and moulds in 10.5 % of cases. The role of C. albicans as the main pathogen in the maceration of the toe web in Egypt is emphasised. The various factors which predispose for such a high incidence are discussed.

Zusammenfassung

448 nicht ausgesuchte ambulante Patienten des Hospitals der Ain Shams-Universität wurden klinisch auf Pilzbefall der Zehengewebe untersucht. 174 davon waren Männer, 274 waren Frauen. Zeichen von Tinea interdigitalis pedis wiesen 54 (= 31,1 %) Männer und 92 (= 33,6 %) Frauen auf.

Aufgrund dieser orientierenden Voruntersuchung wurden nun 304 Fälle mit klinischen Erscheinungen mykologisch untersucht, 89 Männer und 215 Frauen. Das Alter betrug meist zwischen 11 und 50 Jahren, unter 10 Jahren waren nur 3 Personen, über 50 Jahre deren 12.

Das Nativpräparat erwies sich in 112 Fällen als positiv; nicht nur Pilzfäden, sondern auch sicher erkennbare Sproßzellen wurden als „positiv" gewertet.

Kulturell wurden in weitaus überlegener Anzahl Hefen der Gattung Candida gezüchtet, insgesamt 64,4 %, nur eine verhältnismäßig geringe Anzahl von Dermatophyten, nämlich 4,6 %, und 10,5 % Schimmelpilze.

Die Differenzierung der Pilze ergab: 164 C. albicans, 4 C. tropicalis, 2 C. stellatoidea, 2 C. catenulata, 24 nicht identifizierte Candida-Hefen; 12 Trichophyton rubrum und 2 T. mentagrophytes.

Die besondere Rolle von C. albicans, die nicht zur normalen, sondern zur pathogenen Hautflora gehört, wird diskutiert. Die enttäuschenden Ergebnisse der Grieofulvinbehandlung bei Hefebefall werden hervorgehoben. Die Behandlung mit Candida-wirksamen Medikamenten ist erforderlich.

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