Bacterial colonization in diabetic and non-diabetic patients with Athlete's foot

Thesis

Submitted for Partial Fulfillment of M.Sc. in
DERMATOLOGY

By

Shady Hassan El-Maghraby
(M.B., B.Ch.)

Supervised by

Prof. Amr Abdel-Hakim Rateb
Professor of Dermatology,
Faculty of Medicine, Cairo University

Dr. Iman Muhammad Amin
Assist. Professor of Dermatology,
Faculty of Medicine, Cairo University

Dr. Nadia Madany
Lecturer of Microbiology,
Faculty of Medicine, Cairo University

FACULTY OF MEDICINE
CAIRO UNIVERSITY

2014

ACKNOWLEDGMENTS

*First of all, I am deeply thankful to **Allah** by the grace of whom this work was possible.*

*I wish to express my deepest gratitude to **Prof. Amr Rateb**, Professor of Dermatology, Faculty of Medicine, Cairo University, for his kind support and supervision. It was by his continuous guidance that this work came to light.*

*Also, I would like to thank **Assist. Prof. Iman Amin**, Assist. Professor of Dermatology, Faculty of Medicine, Cairo University for her kindness, great support and meticulous revision throughout the research work.*

*I would also like to thank **Assist. Prof. Nadia Medany**, Assist. Prof. of Microbiology, Faculty of Medicine, Cairo University, for her great effort and indispensable help throughout the practical part of this work.*

*Finally, I would also like to thank my **father**, **mother** and **family** for the support they provided me through my entire life.*

Abstract

In resistant and recurrent cases of Athlete's foot, bacterial superinfection should be suspected, culture and sensitivity tests should be done for both fungal and bacterial organisms, and antibiotics must be prescribed if the results show bacterial growth. Patient education is important to aware the patients and their families about the foot hygiene, especially in cases with diabetes mellitus who may suffer from foot ulcers, impaired wound healing, cellulites and diabetic foot which may end by lower limb amputation.

Keywords: Athlete's foot- C. parapsilosis- HSGs- T. Tonsurans

TABLE OF CONTENTS

List of Abbreviations

C. albicans	Candida albicans
C. dubliniensis	Candida dubliniensis
C. guilliermondii	Candida guilliermondii
C. parapsilosis	Candida parapsilosis
DM	Diabetes mellitus
DTH	Delayed-type hypersensitivity
E. Floccosum	Epidermophyton floccosum
FFI	Fungal foot infection
Gram +ve	Gram positive
Gram -ve	Gram negative
HSGs	Hyphae-specific genes
M. Canis	Microsporum canis
PL	Phospholipases
SAP	Secreted aspartyl proteinases
T. Mentagrophytes	Trichophyton mentagrophytes
T. Rubrum	Trichophyton rubrum
T. Tonsurans	Trichophyton tonsurans

List of Figures

List of Tables

Introduction

Athlete's foot is the most common presentation of Tinea Pedis. It refers to interdigital maceration, pruritus and malodor, which occur particularly between the lateral three toes. This chronic intertriginous type, begins as scaling, erosion, and erythema of the interdigital and subdigital skin of the feet ***(Verma et al., 2007).***

Tinea pedis is estimated to be the second most common skin disease in the United States, behind acne ***(Weinstein et al., 2002)***, and up to 15% of the population may manifest the disease ***(Bell-Syer et al., 2002).***

Three species of fungi; Trichophyton rubrum, Trichophyton mentagrophytes, and Epidermophyton floccosum are together responsible for the vast majority of cases of tinea pedis throughout the world ***(Al Hasan et al., 2004).***

Trichophyton rubrum accounted for over 76% of all dermatophyte infections, including tinea pedis, and may account for over 2/3 of all tinea pedis infections ***(Weinstein and Berman, 2002)***.

Typically, the interweb space is colonized by polymicrobial flora. Initially, a dermatophyte infection at this site may damage the stratum corneum and produce natural substances with antibiotic properties that alter the composition of the resident bacterial flora, encouraging the proliferation of antibiotic-resistant strains ***(Lin et al., 2011).***

Organisms not normally considered as resident members of the skin flora may sometimes colonize and become established in modest numbers for relatively long periods. Bacteria of this intermediate category have been labeled temporary residents ***(Hay et al., 2010).***

Gram-negative mixed bacterial infection with organisms may represent a mild secondary infection of tinea pedis. Over time, in the setting of moisture and maceration, multiple fungal and bacterial organisms may proliferate. The process may progress to advanced stages of gram-negative infection with sepsis ***(Karaca et al., 2008).***

High glucose levels in urine, general tissue fluids and sweat may make diabetics more susceptible to candidosis . Phagocytosis is also impaired in diabetics ***(Tapper-Jones et al., 1981).***

In diabetic patients, fungal infection is a very common foot problem and if left untreated can threaten tissue viability leading to secondary bacterial

infection and cellulitis. Management of fungal disease is often considered difficult due to high relapse and re-infection rates, although by introducing a combination of therapies, the success in treating this stubborn condition can be greatly improved ***(Bristow, 2008).***

AIM OF THE WORK

The aim of the study is to compare between bacterial colonization in Athlete's foot in diabetic and non-diabetic patients.

Resident and Transient Bacterial Flora:

The normal human skin is colonized by huge numbers of bacteria that live harmlessly as commensals on its surface and within its follicles. At times, overgrowth of some of these resident organisms may cause minor disease of the skin or its appendages. On other occasions, bacteria not normally found there may colonize the epidermis and lead rapidly to disease. Apart from the arrival of these frankly pathogenic organisms, a wide range of bacteria land more or less fortuitously on the skin, and linger briefly in small numbers before disappearing, unable to multiply and thrive in this relatively inhospitable environment. Bacteriological sampling will reveal the presence of these otherwise unsuspected 'transients' ***(Madhu et al., 2005).***

Organisms not normally considered as resident members of the skin flora may sometimes colonize and become established in modest numbers for relatively long periods. Bacteria of this intermediate category have been labeled temporary Residents ***(Hay et al., 2010).***

Temporary resident bacteria may confuse the picture, being less easy to distinguish from stable commensal organisms than obvious transients. It is possible, however, to describe a basic pattern of colonization of healthy human skin from which some variations may be observed. In simple terms, dry skin supports a low level of colonization, while moist areas and those well supplied with sebaceous glands are heavily populated. Most organisms reside on the surface of the stratum corneum. These surface dwellers are not evenly distributed but are aggregated into microcolonies of varying sizes comprising perhaps 50 or several

hundred cells. Some may be larger still. The hair follicles are inhabited by anaerobes (Propionibacterium species) in their deeper parts and nearer the surface by aerobic cocci in addition to Malassezia species of yeasts. There are, however, no bacterial inhabitants of sweat ducts or glands, eccrine or apocrine. A variety of antimicrobial peptides are present in the eccrine glands, some more antibacterial than others, and these may be relevant ***(Rieg et al., 2006)***.

The role of the normal flora:

The normal flora of the skin appears to have several functions, of which the most important is probably defence against bacterial infection through bacterial interference. It is almost certainly responsible for the production of free fatty acids from skin lipids. There is considerable evidence that Propionibacterium acnes and the Gram-positive cocci are capable of hydrolyzing lipids of sebum to produce free fatty acids ***(De Luca et al., 2010)***. The acidic environment which results inhibits the growth of other organisms such as Streptococcus pyogenes ***(Stinson et al., 1998)***.

It seems likely from their localization, and from evidence comparing the effects of systemic tetracycline administration with topical neomycin application, that P. acnes deep in the follicles actually undertakes most of this hydrolysis ***(Marples et al., 1971)***.

Apocrine sweat is sterile and odourless when secreted. The odour develops due to bacterial action, mainly attributable to aerobic corynebacteria. ***(Preti et al., 2010)***

In shoe wearers, the fourth toe cleft is often hyperhydrated and the skin macerated. Such conditions sustain an extraordinarily large number of bacteria, mainly the common organisms of the general resident flora, but Gram-negative