Sains Malaysiana 41(6)(2012): 697–700

Common Microorganisms Causing Onychomycosis in Tropical Climate

(Mikroorganisma Penyebab Utama Onikomikosis di Iklim Tropika)

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ABSTRACT

Onychomycosis is the infection of nail apparatus by dermatophytes, yeasts or non-dermatophyte moulds and is responsible for 50% of all nail disorders. A five year retrospective study was conducted at Universiti Kebangsaan Malaysia to identify the common pathogens responsible for onychomycosis and to describe the epidemiology of the affected patients. A total of 278 abnormal nails were cultured, out of which 231 were positive for fungus. Females constituted 50.2% (n=116) while males 49.8% (n=115). The majority (51.9%, n=120) were between ages 50-69 years. The Malay ethnic group was most commonly affected (44.2%, n=102) followed by Chinese (33.8%, n=78), Indians (18.2%, n=42) and other ethnic groups (3.8%, n=9). The most common fungal element isolated was non-dermatophyte moulds (45.4%, n=105) followed by yeast (34.6%, n=80) and dermatophytes (1.3%, n=3). Aspergillus *spp. was the commonest (59.8%,n=81) non-dermatophyte mould, while* Candida *spp. was the commonest yeast (74.3%, n=89) isolated. In this study, non-dermatophyte moulds are the most common microorganisms implicated to cause onychomysosis. Treatment for non-dermatophyte mould is challenging as the current available antifungal agents are more effective against dermatophytes and yeasts.*

Keywords: Aspergillus; *mould; onychomycosis*

ABSTRAK

Onikomikosis adalah jangkitan kuku oleh kulat seperti dermatofit, yis atau kulat selain dermatofit. Ianya merangkumi 50% daripada semua penyakit kuku. Satu kajian retrospektif telah dijalankan di Universiti Kebangsaan Malaysia untuk mengenalpasti patogen penyebab utama onikomikosis dan mengkaji epidemiologi pesakit yang terlibat. Sejumlah 278 sampel kuku yang tidak normal telah dikultur dan 231 daripadanya didapati positif dengan kulat. Kaum wanita mewakili 50.2% (n=116) manakala lelaki mewakili 49.8% (n=115) pesakit yang dikenalpasti dengan onikomikosis. Kebanyakkan pesakit (51.9%, n=120) berumur di antara 50-69 tahun dan terdiri daripada kaum etnik Melayu (44.2%, n=102), Cina (33.8%, n=78), India (18.2%, n=42) dan kumpulan etnik yang lain (3.8%, n=9). Kulat yang paling kerap dikultur adalah kulat selain dermatofit (45.4%, n=105), yis (34.6%, n=80) dan dermatofit (1.3%, n=3). Aspergillus *spp. merupakan kulat selain dermatofit yang paling kerap dikultur (59.8%,n=71), sementara* Candida *spp. pula merupakan yis yang paling kerap (74.3%, n=89) dikultur. Kajian ini menunjukkan bahawa kulat selain dermatofit adalah mikroorganisma penyebab utama onikomikosis. Rawatan untuk onikomikosis disebabkan oleh kulat selain dermatofit adalah sukar memandangkan rawatan yang sedia ada adalah lebih efektif terhadap jangkitan kulat dermatofit.*

Kata kunci: Aspergillus; kulat; onikomikosis

INTRODUCTION

Onychomycosis is defined as the infection of the nail apparatus by dermatophytes, non-dermatophyte moulds or yeasts. It is responsible for 30% of cutaneous mycotic infections (Kaur et al. 2008 & Roberts 1992) and 50% of all nail disorders (Mügge et al. 2006). Onychomycosis predisposes to ulcers, secondary bacterial infections and cellulitis. Clinically it is characterized by nail discoloration (yellow-brown to black), subungual hyperkeratosis and onycholysis (Fitzpatrick et al. 2005).

The prevalence of onychomycosis ranges from 2.2% in USA up to 8.4% in Finland and shows a globally growing trend (Heikkila 1995). Common microbiological agents causing onychomycosis are *Trichophyton* spp., *Candida* spp. and *Aspergillus* spp. There is a wide spectrum of causative agents in different parts of the world. In the West, dermatophytes are the commonest causative agents (Gupta et al. 1998) while in tropical countries, non-dermatophyte moulds and yeasts were found to be common (Kotrajaras et al. 1998; Ng et al. 1999). Risk factors for acquiring onychomycosis include, a previous dermatophyte infection, older age, pre-existing abnormal nail morphology, diabetes, immunodeficiency and possible genetic factors (Tosty et al. 2005). The objective of this study was to identify the common microorganisms responsible for onychomycosis and to describe the epidemiology of the affected patients.

Materials and Methods

This descriptive cross sectional study was conducted with ethical approval from Universiti Kebangsaan Malaysia Medical Center (UKMMC) at the dermatology department of UKMMC. Cases of onychomycosis, confirmed by culture of nail clipping and subungual debris were identified from the microbiology laboratory registry. Universal samplings of all cases with positive nail fungal culture over 5 years (2004 to 2008) were included for analysis. Cases with missing or incomplete documentation were excluded.

The standard procedure of processing nail specimen includes direct microscopic examination and culture. Microscopic examination is done using gram stain, potassium hydroxide 20% and lactophenol cotton blue preparation (Merck, USA). Sabouraud dextrose agar plus chloramphenicol and cycloheximе (Mycobiotic agar, Difco, UK) was used for culture. Cultured was done at 30 °C for 30 days and agar plates are reviewed on a daily basis. Yeast or yeast-like organisms from culture of specimens are further tested using germ tube test, urease test and cornmeal agar (Oxoid, UK). Moulds are further subjected to testing using slide culture on potato dextrose agar (Oxoid, UK). Pathogens are classified as yeast and yeast-like organisms, dermatophytes and non-dermatophyte moulds.

Results

A total of 278 nail samples were cultured, of which 231 were positive for fungal elements. Males and females were equally affected; (49.8%, *n*=115) and (50.2%, *n*=116), respectively. Majority of the patients belong to the Malay ethnic group (44.2%, *n*=102) followed by Chinese (33.8%, *n*=78), Indians (18.2%, *n*=42) and other ethnic groups (3.8%, *n*=9). The age range of the population studied was 2 to 98 years with a mean age of 53.5 ± 18.1 SD years. The most frequently (51.9%, *n*=120) affected were those in the age group 50-69 years

The most common fungal element isolated was non-dermatophyte moulds (45.4%, *n*=105) followed by yeast and yeast-like fungi (34.6%, *n*=80) and dermatophytes (1.3%, *n*=3). The rest of the fungal elements occurred in combinations of these three groups (Table 1).

Aspergillus spp. was the commonest non-dermatophyte mould isolated (59.8%, *n*=71) (Table 2). Among the yeast and yeast-like organisms, *Candida* spp. was cultured in 74.3% (*n*=89) (Table 3).

Discussion

Equal proportion of males and females were found to be affected with onychomycosis in this study. Results pertaining gender preponderance remain debatable as various studies have shown contradicting results. This is probably due to the difference in the local prevalence and help seeking behaviour (Jain & Seghal 2000; Cheng & Choong 2002).

In this study, the age group 50-59 years was commonly affected. An earlier study also observed an incidence of 30% by age 60 years (Summerbell 1997). This is probably related to changes in the immune function as age increases.

The most common fungal elements isolated in this study were non-dermatophyte moulds followed by yeasts and yeast-like fungi and dermatophytes. This finding is in contrast to an earlier local study (Ng et al. 1999) which identified dermatophytes as the commonest organism causing onychomycosis. Another earlier study within the same region also identified dermatophytes as the most common causative organism (Tan 2005). Interestingly, similar results were also observed in a Western study (Mügge et al. 2006). This showed that earlier studies within the tropical and Western regions identified dermatophytes as the leading causative organism responsible for onychomycosis. This difference could be attributed to changes in global climate and humidity favoring the growth different pathogens over the years.

TABLE 1. Fungi isolated from nail culture

Organism	Percentage isolated	*n*
Moulds (non-dermatophytes)	45. 5%	105
Yeast & yeast-like fungi	34.6%	80
Dermatophytes	1.3%	3
Mixed organisms		
Yeast & mould	16.0%	37
Mould & dermatophyte	1.3%	3
Yeast & dermatophyte	0.9%	2
Yeast, mould & dermatophyte	0.4%	1
Total	100%	(n=231)

TABLE 2. Moulds isolated from nail culture

Organism	Percentage isolated	n
I. Hyalohyphomycetes (HHM)		119
Aspergillus spp.	59.8%	71
Fusarium spp.	12.6%	15
Penicillium spp.	5.9%	7
Acremonium spp.	3.4%	4
Paecilomyces sp.	0.8%	1
Arthrographis sp.	0.8%	1
Nonsporulating mould	0.8%	1
Trichoderma sp.	0.8%	1
Aspergillus & Penicillium spp.	6.8%	8
Aspergillus & Fusarium spp.	4.2%	5
Aspergillus & Paecilomyces spp.	1.7%	2
Aspergillus & Acremonium spp.	0.8%	1
Fusarium & Penicillium spp.	0.8%	1
Aspergillus, Penicillium & Paecilomyces spp.	0.8%	1
II. Dematiaceous Mould (DM)		23
Curvularia spp.	39.1%	9
Scyntalidium spp.	17.4%	4
Phialemonium spp.	13.1%	3
Phialophora spp.	13.1%	3
Cladosporium spp.	8.7%	2
Pseudallescheria sp.	4.3%	1
Nattrassia sp.	4.3%	1
III. Black Yeast (BY)		6
Madurella spp.	33.3%	2
Hortaea spp.	33.3%	2
Aureobasidium sp.	16.7%	1
Exophiala sp.	16.7%	1
IV. Zygomycetes		**3**
Rhizomucor sp.	33.3%	1
Rhizopus sp.	33.3%	1
Conidiobolus sp.	33.3%	1

TABLE 3. Yeast and yeast like organisms isolated from nail culture

Organism	Percentage isolated	*n*
Candida spp.	74.3%	89
Trichosporon spp.	8.3%	10
Rhodotorula spp.	5.8%	7
Debaromyces sp.	0.8%	1
Geotrichum sp.	0.8%	1
Saccharomyces sp.	0.8%	1
Sporobolomyces sp.	0.8%	1
Mixed Candida infection		
Candida, Trichosporon & Geotrichum spp.	3.4%	4
Candida & Rodotorula spp.	2.5%	3
Candida, Rodotorula & Trichosporon spp.	1.7%	2
Trichosporon & Saccharomyces spp.	0.8%	1
Total	100%	120

The fact that non-dermatophyte mould is the most common pathogen implicated for onychomycosis in this population, poses a challenge as its response to oral antifungal is unpredictable. The current available antifungal agents are more effective against dermatophytes and yeasts. Avulsion of the effected nail and treatment with oral antifungal may be the best available option in cases of infection with non-dermatophyte moulds (Robert et al. 2003).

CONCLUSION

This study showed that the commonest causative pathogen for onychomycosis is non-dermatophyte moulds followed by yeasts, yeast-like fungi and dermatophytes. This finding is in contrast to earlier studies in the same tropical region where dermatophytes were identified as the common pathogen. Onychomycosis frequently affects those over the age of 50 years and involves both males and females equally. Treatment against non-dermatophyte moulds is challenging as the currently available antifungal agents are more effective for infections with dermatophyte and yeast.

ACKNOWLEDGEMENT

The researchers would like to thank UKMMC for funding this project.

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Received: 18 October 2011
Accepted: 22 December 2011