

Original Article

Epidemiology of Onychomycosis in Indonesia: Data Obtained from Three Individual Studies

Kusmarinah Bramono and Unandar Budimulja

Department of Dermato-Venereology, Medical Faculty,
University of Indonesia, Jakarta, Indonesia

[Received: 2, November 2004. Accepted: 10, February 2005]

Abstract

In terms of both diagnosis and treatment, onychomycosis remains a problem in Indonesia. To examine this situation, we performed a retrospective study of the incidence of onychomycosis involving 10 state university hospitals across the country.

We collected data from medical records of patients treated at these hospitals in 1997-1998 (study 1) and from a 1998-1999 multi-center Indonesian study on pulse-dose itraconazole therapy (study 2), both of which were part of onychomycosis campaigns with the objective of increasing the awareness of physicians of onychomycotic problems. Further, we analyzed data from year 2003 medical records of patients from 4 hospitals in Java (study 3). The average incidence of onychomycosis among fungal diseases increased to 4.7% in large cities that, from an average incidence within Indonesia of 3.5% in 1997-1998.

At only 0.5%, the incidence of onychomycosis among all skin diseases was low in both study 1 and 3. Female patients outnumbered male patients with a ratio of 1.5:1 to 2:1. In study 2, the fingernail was the site most frequently affected.

KOH examinations and fungal culture in study 1 (n=557) showed causative organisms to be *Candida* (50.1%), dermatophytes (26.2%), moulds (3.1%) and mixed infections (1.8%), with the remainder (18.7%) unidentified. Similar frequency of causative organisms was reported in study 2 (n=113) and in study 3 (n=183). People's low awareness of nail disease and consequent lack of concern as well as the limited diagnostic ability of KOH examination and fungal culture might influence the low incidence of the disease and the frequency of detection of the causative organisms.

Key words: Onychomycosis, prevalence, causative organism, Indonesia

Introduction

Until the late 1990's, onychomycosis was a poorly discussed topic of medical science in Indonesia. Even in financially more advanced Asian countries, onychomycosis has been highlighted only in the last decade. Unlike in western countries where it is the frequent cause of nail disorders, in Southeast Asia the prevalence of onychomycosis is relatively low. This was partially confirmed by a large scale-survey in Asia in the late 1990's, in which the prevalence of onychomycosis was lower in tropical countries (3.8%) than in subtropical countries and countries in the temperate zone (18.0%)¹⁾.

In Indonesia, higher priorities in socioeconomic concerns and health issues for other diseases have resulted in low awareness of onychomycosis by physicians and the general public alike. Until recently, basic diagnostic procedures were not uniform even in the main dermatologic training hospitals. Diagnosis was primarily based on KOH examination, and fungal culture examinations were performed in only 6 of 12 state university hospitals in the country. However, the incidence of onychomycosis is expected to increase continuously as a result of extended life expectancy, increasing numbers of immunocompromised individuals, changing lifestyles, and with increase in the number of participants in sports.

In an effort to foster physicians' cooperation to diagnose and treat onychomycosis, several activities have been conducted since 1996 by

Corresponding author: Kusmarinah Bramono
Jl. Bambu Kuning # 15 Jakarta 12560, Indonesia
Department of Dermato-Venereology, Medical Faculty,
University of Indonesia, Jakarta, Indonesia

the Indonesian Society for Human and Animal Mycology (INSHAM) and the Indonesian Study Group for Dermatomyology (ISGD). Every state university hospital has one or more representatives of the ISGD. The sponsored activities include seminars, courses, epidemiology surveys, and multi-center research for the treatment of onychomycosis. In addition, beginning in 1997, more hospitals established complete laboratory facilities and began to follow similar procedures for the diagnosis of this condition.

Here we report the data of epidemiologic study on onychomycosis in Indonesia compiled during and after the onychomycosis campaigns.

Subjects and Methods

Collection of epidemiological data from 1997-1998

Initial epidemiological data concerning the incidence of onychomycosis in Indonesia were collected at the end of 1998 through questionnaires. These forms were sent to various state university hospitals that have been performing mycological examination (microscopy and culture) for the diagnosis of onychomycosis. Information was collected from the medical records of newly visited outpatients diagnosed with this condition from 1997 to 1998. This consisted of patient age and gender as well as the causative agent isolated by fungal culture. Also recorded was the total number of patients with fungal skin disease and the total number of patients with any kind of skin disease in the years 1997-1998.

Epidemiological data from a pulse-dose itraconazole therapy study

Additional epidemiological data were obtained from 1998 to 1999 on a pulse-dose itraconazole therapy study for onychomycosis due to dermatophytes and yeasts. The study was performed by recruiting all patients who attended the dermatovenereology outpatient clinics at 10 state university hospitals from January 1998 to June 1999. Patients with onychomycosis (due to dermatophytes and yeasts) were eligible to participate if they provided informed consent and none of the following exclusion criteria: pregnancy, lactation, psoriasis, use of topical anti-fungal treatment within the previous 2 weeks, use of a systemic anti-fungal agent within the previous 2 months, current use of other drugs that might interact with itraconazole, and history of azole hypersensitivity.

Following consensus on the study protocol, all hospitals used the same procedures in the diagnosis and confirmation of the causative

agent. The clinical appearance and location of onychomycosis (toenail or fingernail) were documented. One toenail and/or one fingernail was selected from each patient for long-term follow-up (target nails). The nail specimen were examined by light microscopy with KOH and were cultured on two kinds of media (Sabouraud peptone-glucose agar and Sabouraud peptone-glucose agar supplemented with cycloheximide and chloramphenicol).

Growth in the culture medium was viewed as confirmation of dermatophytes as etiologic agents. Confirmation of *Candida* species required both a positive culture and observation of pseudomycelium under light microscopy with KOH. When the light microscopy of a nail specimen showed filaments with only a non-dermatophyte growth in culture, a second nail specimen was examined again by light microscopy and culture to confirm non-dermatophytic mould infection. Patients with mould infection or negative culture were excluded from the study.

Onychomycosis data in 2003

To evaluate a possibility of increased incidence of onychomycosis, we asked state university hospitals located in big cities on Java Island for information on cases of the disease in 2003. Requested data from hospital medical records consisted of the number of newly visited onychomycosis cases, the age and gender of the patient, and causative agents isolated by the culture. Four hospitals responded to our request.

Results

Epidemiological data from 1997-1998 (study 1)

Epidemiological data on onychomycosis cases treated in 1997-1998 at university hospitals in

Tabel 1. Incidence of onychomycosis in 10 state university hospitals in Indonesia year 1997-1998

City	Onychomycosis n	% among skin fungal diseases	% among skin diseases
Bandung	47	2.2	0.3
Denpasar	55	5.6	0.8
Jakarta	93	2.6	0.5
Makassar	43	3.6	0.5
Manado	30	4.1	0.7
Medan	75	3.0	0.6
Semarang	40	3.2	0.3
Solo	40	4.5	0.8
Surabaya	94	3.8	0.8
Yogyakarta	40	2.5	0.4
Total	557	3.2	0.5

Table 2. Distribution of patients with onychomycosis in 10 state university hospital according to age and gender in 1997-1998

Age group (years)	Male	Female	Total
0-15	9	15	24
>15-25	26	58	84
>25-45	69	177	246
>45-65	65	110	175
>65	14	14	28
Total	183	374	557

Table 3. Organisms associated with onychomycosis in 10 state university hospitals according to gender, 1997-1998

Organism	Gender		Total	
	Male	Female	n	%
<i>Candida</i> sp.	74	205	279	50.1
Dermatophytes	56	90	146	26.2
Mould	4	13	17	3.1
Mixed	5	5	10	1.8
Unidentified ^{*)}	44	61	105	18.9
Total	183	374	557	100.0

^{*)} Unidentified used either when culture was negative or was not performed

provincial capitals were obtained from 10 hospitals in which fungal culture examination was done on at least 50% of their cases. The medical data collected did not specifically differentiate between fingernail or toenail onychomycosis.

Table 1 shows the number of cases and the incidence of onychomycosis among all fungal skin diseases and among all skin diseases seen at the 10 participating hospitals in the period. All onychomycosis cases included were at least KOH-examination positive cases. The incidence of onychomycosis among fungal skin diseases was 3.2%, and comprised 0.5% of all skin diseases. Table 2 presents the distribution of cases by gender and by the age grouping used by the Ministry of Health in the hospital medical record system. Onychomycosis was most prevalent in the 25 to 45-year age group, and the ratio of male to female onychomycosis patients was approximately 1:2.

Information on causative organism was available in only 452 cases (81.1% of KOH-examination positive cases). Table 3 presents the distribution of causative organism according to patient gender. The organism isolated most frequently in culture was *Candida* sp. or yeast (50.1%), followed by dermatophytes (26.2%) and moulds (3.1%). In 1.8% of cultures, a mixtures of dermatophyte and *Candida* or yeast or moulds

Table 4. Patient characteristics in the study of pulse dose itraconazole year 1998-1999

Characteristics	n	%
Age group		
<25 yrs	17	15.0
25-50 yrs	69	61.1
>50 yrs	27	23.9
Gender		
Male	43	38.1
Female	70	61.9
Number of affected nails		
toenails	50	44.2
fingernail	93	82.3

Table 5. Isolated fungal agents according to location in the study of pulse dose itraconazole year 1998-1999

Species	Toenails	Fingernails	Total
<i>T. rubrum</i>	6	11	17
<i>T. mentagrophytes</i>	5	4	9
<i>Trichophyton</i> sp.	4	4	8
<i>M. gypseum</i>	0	1	1
<i>Candida</i>	23	67	90
<i>Trichophyton</i> & <i>Candida</i>	0	2	2
Total	38	89	127

was recovered.

Data from the multi-center onychomycosis study (study 2)

A total of 113 patients enrolled in the study of pulse-dose itraconazole therapy for onychomycosis. The age distribution was similar to that seen in the study 1 medical chart review of onychomycosis cases (Table 4), however, the age group intervals used in this study differed slightly from the standard age group intervals in study 1.

The highest prevalence of onychomycosis was among the 25-50 year age group, and the male to female ratio was approximately 1 to 2, consistent with the results of study 1. The data revealed a higher prevalence of fingernail than toenail onychomycosis, with 93 patients having the former compared to 50 with the latter. Positive culture was obtained in 127 selected target nails; Table 5 presents the distribution of causative fungi. The patients with mould infection were excluded from the study. *Candida* sp. or yeasts affected 90 target nails (70.8%) and dermatophytes affected 35 target nails (27.6%). A mixture of dermatophyte and *Candida* or yeast was detected in 2 cases (1.6%).

Tabel 6. Incidence of onychomycosis in 4 state university hospitals on Java Island, year 2003

City	Onychomycosis n	% among skin fungal diseases	% among skin diseases
Bandung	58	6.1	0.9
Jakarta	44	3.5	0.5
Surabaya	44	4.7	0.4
Yogyakarta	37	4.9	0.3
Total	183	4.7	0.5

Epidemiological survey in 2003 (study 3)

Table 6 presents the incidence of onychomycosis reported in four state university hospitals on Java Island in 2003. The average incidence was 4.7% among patients with fungal skin diseases, and 0.5% among all patients with skin diseases. Females still outnumbered males at approximately 1.5 to 1.

Only three hospitals reported the results of positive fungal cultures. From clinical and KOH microscopic examinations, a dermatophyte infection was indicated in 51 of 146 cases (34.9%) and *Candida* or yeast in 91 of the 146 cases (62.3%), the causative organism was undetermined in the remaining 4 cases (2.7%). However, positive cultures were detectable in less than 25% of those with suspected dermatophyte infection by KOH examinations; in those cases *T. rubrum* was most frequently isolated. *Candida* culture was positive in all suspected *Candida* or yeast onychomycosis by KOH examinations.

Discussion

Despite increased interest in onychomycosis by dermato-venereologists and despite improvements in diagnostic procedures in the hospitals in the study, the reported incidence of onychomycosis among patients with skin problems in the year 1997-1998 was low (0.5%), suggesting that onychomycosis is an under-reported disease. A mass survey on foot diseases, the so-called Indonesian Achilles project in 1999, has shown that 3.4% of 16,254 individuals were suspected to have toenail onychomycosis¹⁾. This survey also revealed that nail deformity/changes were not of major concern to these people unless they felt pain (unpublished data).

The average incidence of onychomycosis reported among all fungal skin diseases in 4 big cities on Java Island (Bandung, Jakarta, Surabaya and Yogyakarta) in 2003 had slightly increased (4.7%) compared to the incidence reported in the study 1 (4.7% vs. 3.2%, respectively), although the incidence of the condition among all skin diseases was not

significantly different from that reported five years earlier. Java Island is the most developed and the most densely populated area in Indonesia. However, low patient awareness of nail diseases and the low priority given to nail diseases by the healthcare system could have contributed to this low incidence. Similarly, a survey conducted in the UK in 1992 showed that only 34% of patients sought medical help for nail problems.²⁾

Although many reports indicate that the prevalence of onychomycosis increases with age, with the highest prevalence among the elderly more than 60 years old^{3, 4)}, we observed a decreasing prevalence in patients over the age of 65. However, our data were collected from visiting outpatients, most of whom were of working age, and it is possible that our data do not accurately reflect the incidence of onychomycosis among the elderly. We observed the highest incidence of onychomycosis in the age group 25-45/50 years. Finally, corroborating epidemiological reports in other countries^{5, 6)}, our data indicate that onychomycosis is uncommon in children in Indonesia.

It is assumed that habits or culture in individual countries, including gender-related background, make one gender more susceptible to nail fungal infections in a given country, and determine whether toenails or fingernails are more likely to be infected. For example, repeated trauma and wet work are among the predisposing factors for onychomycosis. In Indonesia, household wet work such as laundry and house cleaning is mostly done by housewives, showing a preponderance of female to male patients, at a ratio of 1.5:1 to 2:1 in three studies reported herein. Furthermore, data from study 2 indicated that fingernails were affected more often than toenails (93 compared to 50). It would be likely that hand wet work in female patients is the main predisposing factor for onychomycosis in Indonesia, where laundry without a washing machine is a common practice so that fingernails are always soaked in water. A similar predominance of females in onychomycosis cases was reported in studies from East Asia (China, South Korea and Taiwan)⁷⁾, Tunis⁸⁾, Northern Greece⁹⁾, and Pakistan¹⁰⁾. By contrast, data from USA⁴⁾, Europe⁷⁾, and Canada¹¹⁾ showed a predominance of males in onychomycosis cases, and toenails were more frequently affected than fingernails.

The high cost of laboratory examination, which is borne by patients in Indonesia, caused

some clinically suspect cases of onychomycosis not to be confirmed by mycological culture. Identification of the fungal organism is an important prerequisite in choosing the appropriate antifungal agent. However, cultures often yield negative results, especially in the cases with dermatophyte infection. False positives frequently occurred in the cases with *Candida* or yeast and non-dermatophytic mould infection, since all three organisms could be normal flora colonizing on the nail. In the case with non-dermatophytic moulds, the English criteria (the recovery of the same isolate in 5 or more of 20 inoculum in culture, compatible with the elements detected by direct microscopy) could be used to confirm the diagnosis¹²⁾. In the case of yeast infection, direct microscopy should show pseudohyphae. Except in the itraconazole study, the diagnosis of *Candida* onychomycosis in our study was based on clinical appearance and confirmed by detection of pseudohyphae under KOH microscopic examination. However, a false positive result could occur when pseudohyphae were obtained from the adjacent skin, non-invasive to the nail plate. Histopathology examinations are more accurate tools to confirm the diagnosis of onychomycosis¹³⁾, but are seldom used in Indonesia due to the high cost and unacceptability to most patients.

Candida is the most prevalent organism isolated in Indonesia as the causative agent of this disease. *Candida* onychomycosis occurs more commonly in females than in males and often affects a fingernail, where infection begins as a chronic paronychia or an invasion of an onycholytic nail¹⁴⁾. Hand wet work in female patients will promote chronic paronychia leading to onychomycosis due to *Candida*. A report from Libya corroborated our findings, showing *Candida* sp. to be the dominant cause of onychomycosis in females (but not in males) and fingernails to be the sites most often affected¹⁵⁾.

In the absence of mycological culture to confirm the causes in onychomycosis cases, the high incidence of *Candida* as the causative organism may be overestimated and the incidence of dermatophyte infection may be underestimated. Moreover, these data were based the incidence of onychomycosis in low- to middle-income patients visiting state university hospitals, and might differ from data on patients of higher economic status who attend private medical practice and a private hospital. A larger study is needed to acquire epidemiology data on onychomycosis that more accurately reflect the actual

conditions in Indonesia.

Acknowledgement

The authors would like to thank the Department of Dermato-Venereology in the 10 Medical Faculty of State Universities in Indonesia which were involved in these studies:

1. Pajajaran University - Bandung,
2. Udayana University - Denpasar,
3. University of Indonesia - Jakarta,
4. Hasanuddin University - Makassar,
5. Sam Ratulangi University - Manado,
6. Diponegoro University - Semarang,
7. University of Sebelas Maret, Surakarta,
8. Airlangga University - Surabaya, and
9. Gajahmada University - Yogyakarta.
10. University of Sumatra Utara - Medan

References

- 1) Bramono K: The Asian Achilles Survey. Presented in the 6th Asian Dermatological Congress, Bangkok, November 2001.
- 2) Roberts DT: Prevalence of dermatophyte onychomycosis in the United Kingdom: results of an omnibus survey. *Br J Dermatol* **126**(suppl. 39): 23-27, 1992.
- 3) Heikkala H, Stubbs S: The prevalence of onychomycosis in Finland. *Br J Dermatol* **133**: 699-701, 1995.
- 4) Elewski BE, Charif MA: Prevalence of onychomycosis in patients attending a dermatology clinic in northeastern Ohio for other conditions. *Arch Dermatol* **133**: 1172-1173 (letter), 1997.
- 5) Gupta AK, Sibbald RG, Lynde CW, Hull PR, Prussick R, Shear NH, De Doncker P, Daniel CR, Elewski BE: Onychomycosis in children: prevalence and treatment strategies. *J Am Acad Dermatol* **36**: 395-402, 1997.
- 6) Gill D, Marks R: A review of the epidemiology of tinea unguium in the community. *Australas J Dermatol* **40**: 6-13, 1999.
- 7) Haneke E, Roseeuw D: The scope of onychomycosis: epidemiology and clinical features. *Int J Dermatol* **38**(suppl. 2): 7-12, 1999.
- 8) Anane S, Aoun K, Zallaqua N, Bouratbine A: Onychomycosis in Tunis area: epidemiological and mycological data. *Ann Dermatol Venereol* **128**: 733-736, 2001.
- 9) Koussidou T, Devliotou-Panagiotidou D, Karakatsanis G, Minas A, Mourellou O, Samara K: Onychomycosis in Northern Greece during 1994-1998. *Mycoses* **45**: 29-37, 2002.
- 10) Warshaw E, Ahmed D: Onychomycosis in Lahore, Pakistan. *Int J Dermatol* **38**: 591-595, 1999.
- 11) Gupta AK, Jain HC, Lynde CW, Macdonald P, Cooper EA, Summerbell RC: Prevalence and epidemiology of onychomycosis in patients visiting physicians' offices: a multicenter Canadian survey of 15,000 patients. *J Am Acad*

- Dermatol **43**(2 Pt 1): 244-248, 2000.
- 12) Gupta AK, Cooper EA, MacDonald P, Summerbell RC: Utility of inoculum counting (Walshe and English criteria) in clinical diagnosis of onychomycosis by nondermatophytic filamentous fungi. *J Clin Microbiol* **39**: 2115-2121, 2001.
 - 13) Suarez SM, Silvers DN, Scher RK, Pearlstein HH, Auerbach R: Histologic evaluation of nail clippings for diagnosing onychomycosis. *Arch Dermatol* **127**: 1517-1519, 1991.
 - 14) Hay RJ, Baran R, Moore MK, Wilkinson JD: *Candida* onychomycosis - an evaluation of the role of *Candida* species in nail disease. *Br J Dermatol* **118**: 47-58, 1988.
 - 15) Ellabib MS, Agaj M, Khalifa Z, Kavanagh K: Yeasts of the genus *Candida* are the dominant cause of onychomycosis in Libyan women but not men: results of a 2-year surveillance study. *Br J Dermatol* **146**: 1038-1041, 2002.