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...
the Indonesian Society for Human and Animal Mycology (INSHAM) and the Indonesian Study Group for Dermatomycology (ISGD). Every state university hospital has one or more representatives of the ISGD. The sponsored activities include seminars, courses, epidemiology surveys, and multicenter 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 dermatovenerology 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 ofazole 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-dermatophytic 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 Indonesia are shown in Table 1. The incidence of onychomycosis in 10 state university hospitals in Indonesia year 1997-1998.

<table>
<thead>
<tr>
<th>City</th>
<th>Onychomycosis (%)</th>
<th>% among skin fungal diseases</th>
<th>% among skin diseases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bandung</td>
<td>47</td>
<td>2.2</td>
<td>0.3</td>
</tr>
<tr>
<td>Denpasar</td>
<td>55</td>
<td>5.6</td>
<td>0.8</td>
</tr>
<tr>
<td>Jakarta</td>
<td>93</td>
<td>2.6</td>
<td>0.5</td>
</tr>
<tr>
<td>Makassar</td>
<td>43</td>
<td>3.6</td>
<td>0.5</td>
</tr>
<tr>
<td>Manado</td>
<td>30</td>
<td>4.1</td>
<td>0.7</td>
</tr>
<tr>
<td>Medan</td>
<td>75</td>
<td>3.0</td>
<td>0.6</td>
</tr>
<tr>
<td>Semarang</td>
<td>40</td>
<td>3.2</td>
<td>0.3</td>
</tr>
<tr>
<td>Solo</td>
<td>40</td>
<td>4.5</td>
<td>0.8</td>
</tr>
<tr>
<td>Surabaya</td>
<td>94</td>
<td>3.8</td>
<td>0.8</td>
</tr>
<tr>
<td>Yogyakarta</td>
<td>40</td>
<td>2.5</td>
<td>0.4</td>
</tr>
<tr>
<td>Total</td>
<td>557</td>
<td>3.2</td>
<td>0.5</td>
</tr>
</tbody>
</table>
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 mix of dermatophyte and Candida or yeast or moulds was recovered.

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

A total of 113 patients enrolled in the study of pulse-dose itraconazoletherapy 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%).
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 onychomycosis (1). 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.

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), Tunis (8), Northern Greece (9), and Pakistan (10). By contrast, data from USA (4), Europe (7), and Canada (11) 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 diagnosis\(^\text{12}\). 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 onychomycosis\(^\text{13}\), 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 nail\(^\text{14}\). 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 affected\(^\text{15}\).

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.

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References


