

A Retrospective cohort study of Tinea Pedis and Tinea Unguium in Inpatients in a Psychiatric Hospital

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Abstract

We conducted a retrospective cohort study on clinical and mycological features of tinea pedis and tinea unguium in psychiatric inpatients in Japan. Of the 317 inpatients (152 with schizophrenia and 165 with depression), 46.1 % had tinea pedis and 23.7% had tinea unguium. Of the patients with tinea pedis, 48.6% also had tinea unguium. The most common clinical type of tinea pedis was the combination of interdigital type and hyperkeratotic type. The mean clinical score of tinea pedis was 5.9, and the mean clinical score of tinea unguium based on the Scoring Clinical Index for Onychomycosis (SCIO) was 15.8. The main causative species of tinea pedis were *Trichophyton rubrum* (68.4%) and *T. mentagrophytes* (26.3%). No statistically significant differences were observed in incidence rates of tinea pedis or tinea unguium between men and women or between patients with schizophrenia and those with depression. As for incidence rates by age, patients with depression showed a single peak for tinea pedis and/or tinea unguium in their 50s, while patients with schizophrenia exhibited twin peaks for tinea pedis and/or tinea unguium in their 50s and 70s. Both tinea pedis and tinea unguium tended to become more severe in patients with chronic schizophrenia. Our study suggests that schizophrenia and depression, like diabetes mellitus and HIV infections, should be regarded as risk factors for tinea pedis and tinea unguium.

Introduction

Tinea pedis and tinea unguium are the most common dermatophytoses seen in the daily practice of dermatology. According to a report in JAPAN FOOT WEEK 2006, it is estimated that about 1 in 5 Japanese have tinea pedis and that about 1 in 10 have tinea unguium (1). According to the same report, 49% of the foot diseases of new dermatological outpatients were tinea pedis and/or tinea unguium. Another study indicates that patients with occult athlete's foot account for 25% of all new dermatological outpatients in Japan (2). If interdigital lesions of tinea pedis are left untreated, severe complications, such as phlegmon, will develop. Worsening of tinea unguium can cause pain while walking, leading to a significant deterioration of the quality of daily life. Daily foot care is extremely important for patients with underlying diseases, such as diabetes mellitus, renal failure, and immunodeficiency.

Inpatients in a psychiatric hospital may have difficulty in taking care of themselves appropriately, including performing daily foot care. For a variety of reasons, including apathy or lack of interest, a psychiatric inpatient with tinea pedis might not be able to maintain the proper hygiene and foot care necessary to treat the disease, and the condition of the foot could worsen. To our knowledge, however, there are few studies internationally regarding clinical and mycological features of tinea pedis and tinea unguium in psychiatric patients (3).

We conducted a retrospective cohort study on the clinical and mycological features of tinea pedis and tinea unguium in inpatients in a psychiatric hospital in Tokyo, Japan. Here we report the findings from that study.

Patients and methods

Patients: We performed a retrospective review of the medical charts of all patients with schizophrenia or depression who were admitted to Juntendo University Koshigaya Hospital, during a 2-year period from January 2008 to December 2009. Juntendo University Koshigaya Hospital is a psychiatric hospital in Saitama prefecture. At admission or after cancellation of restriction almost all inpatients are examined by both internists and dermatologists, and the medical records note the presence or absence of tinea pedis and tinea unguium, along with the results of any clinical or mycological studies performed. We screened the records for patients who were positive for tinea pedis or tinea unguium. Ethics Board approval was not required for this study

Methods: The results of any clinical or mycological studies are described in the medical records. Based on the description in the medical records, we conducted a retrospective study on the following items: sex, age, height, weight, and primary diagnosis that led to hospitalization (mainly schizophrenia and depression). When tinea pedis or tinea unguium was suspected, dermatologists collected specimens for mycological analysis from the sites of possible dermatophyte infection in the feet and toenails, and subjected them to direct microscopy in potassium hydroxide (KOH). When fungus elements were positive (KOH-positive), causative species were identified by culturing the fungi on Sabouraud's glucose agar.

Tinea unguium

The clinical types of tinea unguium were distal and lateral subungual onychomycoses (DLSO), superficial white onychomycosis (SWO), proximal subungual onychomycosis (PSO), and total dystrophic onychomycosis (TDO). The clinical symptoms of tinea unguium were

primarily subungual hyperkeratosis, with the end nail plate becoming rough and fragile. Severity of tinea unguium was assessed using the SCIO score (5).

Tinea pedis

The clinical types of tinea pedis were classified as interdigital type, vesicular type, and hyperkeratotic type. The intermediate types were expressed as interdigital + vesicular type, interdigital + hyperkeratotic type, and interdigital + vesicular + hyperkeratotic type. The hyperkeratotic type was defined as dry-type tinea pedis (Moccasin foot or dry-type infection) according to Rook's Textbook of Dermatology (4).

Clinical symptoms of tinea pedis were itching, erythema, vesicles or pustules, maceration, erosion, scaling, and hyperkeratosis. The severity of each clinical symptom was assessed with ratings of 0 to 3 as follows: 0, absent; 1, mild; 2, moderate, and 3, severe. The total scores for clinical signs were then calculated.

As shown in Table 1, the severity of tinea pedis was described by a combination of disease stage and area affected by lesions (6). Three disease stages were recognized: (i) early stage, characterized by interdigital scaling and vesicles on the arch of the foot; (ii) middle stage, characterized by interdigital maceration and mild keratinization; and (iii) late stage, characterized by moderate or severe keratinization and complications with tinea unguium. The extent of the area affected by lesions was classified as (i) limited, i.e., lesions covering a part of interdigital areas and/or the arch of one foot; (ii) intermediate, i.e., lesions confined to one foot only, but covering the entire sole of one foot; and (iii) widespread, i.e., lesions affecting both feet. We made a database from these check points for this study. Statistical analysis was performed using the Student's t-test and chi-squared tests.

Results

Incidence rates and clinical symptoms of tinea pedis and tinea unguium

Among the patients admitted to this hospital during 2008 and 2009, a total of 317 patients (152 with schizophrenia and 165 with depression) received dermatological examination. The ages ranged from 16 to 87, with the following distribution: 10 to 19 years of age, 8 patients; 20 to 29, 33 patients; 30 to 31, 58 patients; 40 to 49, 57 patients; 50 to 59, 70 patients; 60 to 69, 50 patients; and 70 or older, 41 patients. The incidence rate of tinea pedis in the study population was 46.1%, and the incidence rate of tinea unguium was 23.7%. Additionally, 71(48.6%) of the 146 patients with tinea pedis also had tinea unguium.

No statistically significant differences in tinea unguium or tinea pedis incidence rates were observed between the patients with schizophrenia and those with depression or between men and women. In the overall study population, the mean clinical score for tinea pedis was 5.9, and the mean SCIO score for tinea unguium was 15.8.

The distribution of the total clinical score for tinea pedis peaked at a score of 6. Scores of 7 and higher due to high scores of scaling and hyperkeratosis were more frequently observed in patients with schizophrenia (Fig. 2). Hyperkeratosis and unguinal lesions on both feet, which indicate late-stage symptoms in the severity scoring system, were observed more frequently in patients with schizophrenia, compared to patients with depression (Fig. 3). Clinical photo samples of hyperkeratotic type of tinea pedis of the patients with schizophrenia were shown in Fig. 4 & 5.

Within the total study population, the hyperkeratotic type of tinea pedis was prevalent, as shown by the following distribution of tinea pedis by clinical type: interdigital type, 51 patients (35%); interdigital type + hyperkeratotic type, 50 patients (34%); hyperkeratotic type, 31 patients (21%); and vesicular type, 15 patients (10%). DLSO was the most prevalent clinical type of tinea unguium observed, detected in 43 patients (57%), followed by TDO (29 patients; 39%). SWO was observed in 3 women. We showed a clinical photo sample of DLSO of the patient with depression in Fig. 6.

The incidence rates of tinea pedis and/or tinea unguium varied according to patient age, and the incidence rates differed between patients with schizophrenia and patients with depression. More than 60% of patients with schizophrenia in their 50's or in their 70's had tinea pedis and/or tinea unguium. For patients with schizophrenia, the incidence rate of co-infection with both tinea pedis and tinea unguium was highest (39%) in patients in their 50's (Fig. 1-A). Similarly, the incidence rates of tinea pedis and/or tinea unguium in patients with depression were highest (65%) in patients in their 50's. The incidence rate of the combination of tinea pedis and tinea unguium was highest in patients in their 70's (36%) (Fig. 1-B).

Microscopic-positive specimens were cultured, and 52.1% (76/146) of the tinea pedis cases produced colonies. The clinical isolates included *T. rubrum* (68.4%) and *T. mentagrophytes* (26.3%). By contrast, tinea unguium was culture-positive in only 24 of 75 patients (32.0%); in the 24 culture-positive cases, the clinical isolates were *T. rubrum* (70.8%) and *T. mentagrophytes* (29.2%) (Table 2).

Discussion

The incidence rates of tinea pedis and tinea unguium in outpatients vary depending on reports. According to the 2006 annual study report of the Epidemiological Investigation Committee for Human Mycoses in the Japanese Society for Medical Mycology(7), 12.0% of dermatological outpatients had dermatophytoses, consisting primarily of tinea pedis (63%) and tinea unguium (34.1%). Another report concluded that one-quarter of the population is affected by tinea pedis, when occult cases are included (2). According to the large-scale European study Achilles Foot Screening Project, the incidence rates of both tinea pedis and tinea unguium were each approximately 20% (8, 9). According to a 10-year study from 1995 to 2004 in the United States, the incidence rates of tinea pedis and tinea unguium were 18.8% and 23.2%, respectively (10). In Asia, a study investigating 2000 outpatients in Thailand (11) describes incidence rates of 3.8% and 1.7% for tinea pedis and onychomycosis, respectively, while a study in Hong Kong reported incidence rates of 20.4% for tinea pedis and 16.6% for tinea unguium (12).

Various studies have examined the incidence rates of onychomycosis in patients with underlying diseases or in elderly patients. In one multicenter study, 550 patients with diabetes mellitus were examined, and the incidence rate of onychomycosis was found to be 26% (14). Among patients with peripheral circulatory insufficiency, onychomycosis was found in 22.4% of those with arterial diseases (15) and in 62.2% of those with venous diseases (16). Onychomycosis was reported in 30.3% of patients with HIV (17). and Various reports point to the trend that incidence rates of tinea pedis and tinea unguium increase in middle-aged and elderly patients. For example, tinea pedis and tinea unguium were reported in 25% and 35% of individuals aged 65 years or older, respectively (18).

All of the reports cited above focused on outpatients: virtually no reports have described the incidence rates in inpatients, with the exception of a few reports concerning incidence rates of tinea pedis and tinea unguium in inpatients with diabetes mellitus. A study investigating 267 inpatients with diabetes mellitus found incidence rates of 74.1% for tinea pedis and 48.7% for tinea unguium (13).

To our knowledge, internationally, very few studies have described tinea pedis and tinea unguium in patients with psychiatric diseases, in whom foot care is likely to be neglected because of psychiatric reasons. The present study is the first such study in Japan. In an earlier report from 1967, English et al. (3) examined 358 male long-term psychiatric inpatients and found tinea pedis and tinea unguium in 40.8% of the patients, with *T. interdigitale* (50%) and *T. rubrum* (26%) being the main causative species. These authors attributed the high incidence rate to environmental factors in the particular ward, such as a bath. Mookhoek et al. (19) investigated skin lesions in 91 psychiatric inpatients and reported skin diseases of some sort in 77% of the patients and dermatophytoses in 35.2% of the patients. In their study the high incidence rate of skin infections was attributed to the presence of many overweight patients or patients with diabetes mellitus. Kuruvila et al. (20) observed dermatophytoses in 24.4% of 300 patients with psychiatric diseases and reported high frequencies of tinea corporis and tinea cruris.

In this study, we observed tinea pedis and tinea unguium in 44.7% and 24.3%, respectively, of 152 psychiatric inpatients with schizophrenia. We found similar incidence rates of tinea pedis (47.3%) and tinea unguium (23.0%) in 165 psychiatric inpatients with depression. The survey by Japan Foot Week 2006 reported that tinea pedis was observed in about 1 in 5 people and that tinea unguium was observed in about 1 in 10 people (1); thus, the incidence rates found in our present study are more than twice as high as those reported in the general Japanese

population. Notably, the incidence rates we found in our study were lower than those reported for inpatients with diabetes mellitus (13). We found no statistical differences in the incidence rates of tinea pedis and tinea unguium between men and women or between patients with schizophrenia and those with depression.

In investigating the causative agents of tinea pedis and/or tinea unguium, we found that 68% of the clinical isolates were *T. rubrum* and 26% *T. mentagrophytes*, producing a so-called TR/TM ratio of 2.6. This TR/TM ratio is higher than the TR/TM ratio of 1.7 reported by the Epidemiological Investigation Committee for Human Mycoses in the Japanese Society for Medical Mycology (7). In our study population the incidence rate of *T. rubrum* was relatively high, possibly a reflection of the fact that *T. rubrum* was isolated from hyperkeratotic-type tinea pedis in most of the patients with chronic schizophrenia.

Both tinea pedis and tinea unguium tended to get increasingly more severe in patients with chronic schizophrenia. Patients with psychiatric diseases often cannot take care of their feet properly, as their psychiatric symptoms can lead them to become apathetic or uninterested. This situation may explain why psychiatric patients tend to contract tinea pedis and/or tinea unguium and why their clinical symptoms worsen. In addition, these patients frequently engage in behaviors, such as constant walking, that place burden on their feet and increase the likelihood of easily contracting tinea pedis and tinea unguium. In our study, we frequently observed hyperkeratotic-type tinea pedis, and the prevalence of this clinical type may be related to the characteristics unique to patients with psychiatric diseases as described above. In conclusion, our study suggests that schizophrenia and depression, like diabetes mellitus and HIV infections, should be regarded as risk factors for tinea pedis and tinea unguium

Declaration of interest: The authors report no conflicts of interest. The authors alone are responsible for the content and the writing of the paper.

References

1. Watanabe S, Harada T, Hiruma M, Iozumi K, Katoh T, Mochizuki T, Naka W, Japan Foot Week Group: Epidemiological survey of foot diseases in Japan: Result of 30000 foot checks by dermatologists. *J Dermatol* **37**: 397-406, 2010.
2. Ogasawara Y, Hiruma M, Muto M, Ogawa H: Clinical and mycological study of occult tinea pedis and tinea unguium in dermatological patients from Tokyo. *Mycoses* **46**: 114-119, 2003.
3. English MP, Wethered RR, Duncan EH: Studies in the epidemiology of tinea pedis: Fungal infection in a long-stay hospital. *Brit Med J* **3**: 136-139, 1967.
4. Hay RJ, Moore MK: Dermatophytosis, In: Burns T, Breathnach S, Cox N, Griffith C (eds): *Rook's Textbook of Dermatology*, Vol 2, 7th Ed, Oregon, Blackwell Science 31: 19-31, 55, 2004.
5. Sergeev AY, Gupta AK, Sergeev YV: The Scoring Clinical Index for Onychomycosis (SCIO Index). *Skin Therapy Lett* **7**: 6-7, 2002.
6. Noguchi H, Hiruma M, Kawada A, Ishibashi A, Kono S: Tinea pedis in members of the Japanese Self-defense Forces: relationships of its prevalence and its severity with length of military service and width of interdigital spaces. *Mycoses* **38**: 494-499, 1995.

7. 2006 Epidemiological survey of Dermatomycoses in Japan (Epidemiological investigation Committee for Human Mycoses in the Japanese Society for Medical Mycology) Co-chairman and reporter: Sei Y. *Med Mycol J* **53**:185-192, 2012.
8. Haneke E: Achilles foot-screening project: background, objectives and design. *J Eur Acad Dermatol Venereol* **12**: S2-S5, 1999.
9. Roseeuw D: Achilles foot-screening project: preliminary results of patients screened by dermatologists. *J Eur Acad Dermatol Venereol* **12**: S6-S9, 1999.
10. Panackal AA, Halpern EF, Watson AJ: Cutaneous fungal infections in the United States: Analysis of the National Ambulatory Medical Care Survey (NAMCS) and National Hospital Ambulatory Medical Care Survey (NHAMCS), 1995-2004. *Inter J Dermatol* **48**: 704-712, 2009.
11. Ungpakorn R, Lohapathan, Reangchainam S: Prevalence of foot diseases in outpatients attending the Institute of Dermatology, Bangkok, Thailand. *Clin Exp Dermatol* **29**: 87-90, 2004.
12. Cheng S, Chong L: A prospective epidemiology study on tinea pedis and Onychomycosis in Hong Kong. *Clin Med J* **115**: 860-865, 2002.
13. Arai T, Konaka R, Wakita K, Katsuoka K, Kanamori A: Investigation of dermatological symptoms for inpatients with diabetes mellitus. *Jpn J Dermatol* **119**: 2359-2364, 2009.
14. Gupta AK, Konnikov N, MacDonald P, Rich P, Rodger NW, Edmonds MW, MacManus R, Summerbell RC: Prevalence and epidemiology of toenail onychomycosis in Diabetic subjects: a multicentre survey. *Br J Dermatol* **139**: 665-671, 1998.

15. Gupta AK, Gupta MA, Summerbell RC, Cooper EA, Konnikov N, Albreski D, MacDonald P, Harris KA: The epidemiology of onychomycosis: possible role of smoking and peripheral arterial disease. *J Eur Acad Dermatol Venereol* **14**: 466-469, 2000.
16. Shemer A, Nathansohn N, Kaplan B, Trau H: Toenail abnormalities and onychomycosis in chronic venous insufficiency of the legs: Should we treat? *J Eur Acad Dermatol Venereol* **22**: 279-282, 2008.
17. Gupta AK, Taborda P, Taborda V, Gilmour J, Rachlis A, Salit I, Gupta MA, MacDonald P, Cooper EA: Epidemiology and prevalence of onychomycosis in HIV-positive individuals. *Int J Dermatol* **39**: 746-753, 2000.
18. Rodriguez ME, Fernandez CM, Moya S, Rodriguez RM, Martinez G: Clinico-mycological study of onychomycosis in elderly patients. *Rev Inst Med Trop Sao Paulo* **35**: 213-217, 1993.
19. Mookhoek EJ, Kerkhof PCM, Hovens JEJM, Brouwers JRBJ, Loonen AJM: Skin disorders in chronic psychiatric illness. *J Eur Acad Dermatol Venereol* **24**: 1151-1156, 2010.
20. Kuruvia M, Ghalaut P, Zacharia A: A study of skin disorders in patients with primary psychiatric conditions. *Indian J Dermatol, Venereol Leprol* **70**: 292-295, 2004.

Table 1 Severity of tinea pedis by stage and extent

	Extent of lesion		
Stage	Localized	Moderate	Widespread
Early	1	2	3
Intermediate	2	3	4
Late	4	5	6

Table 2. Prevalence rate, clinical scores and isolated pathogens of tinea pedis and tinea unguium in inpatients with schizophrenia and depression

	total number of patients	schizophrenia	depression
	N=317	N=152	N=165
average age	47.3±16.8	45.7±16.4	48.7±17.3
tinea pedis	146/317 (46.1%)	68/152 (44.7%)	78/165 (47.2%)
clinical symptom scores	5.9±2.3	6.2±2.7	5.8±2.0
culture positive	76/146 (52.1%)	35/68 (51.5%)	41/78 (52.6%)
pathogen of tinea pedis			
<i>T.rubrum</i>	52/76 (68.4%)	22/35 (28.9%)	30/41 (73.1%)
<i>T.mentagrophytes</i>	20/76 (26.3%)	10/35 (28.6%)	10/41 (24.4%)
tinea unguium	75/317 (23.7%)	37/152 (24.3%)	38/165 (23.0%)
SCIO scores	15.8±7.6	14.7±7.4	16.2±8.2
culture positive	24/75 (32.1%)	12/37 (32.4%)	12/38 (31.6%)
pathogen of tinea unguium			
<i>T.rubrum</i>	17/24 (70.8%)	8/12 (66.7%)	9/12 (75.0%)
<i>T.mentagrophytes</i>	7/24 (29.2%)	4/12 (33.3%)	3/12 (25.0%)

Fig. 1-A Age distribution prevalence of tinea pedis and tinea unguium in inpatients with schizophrenia

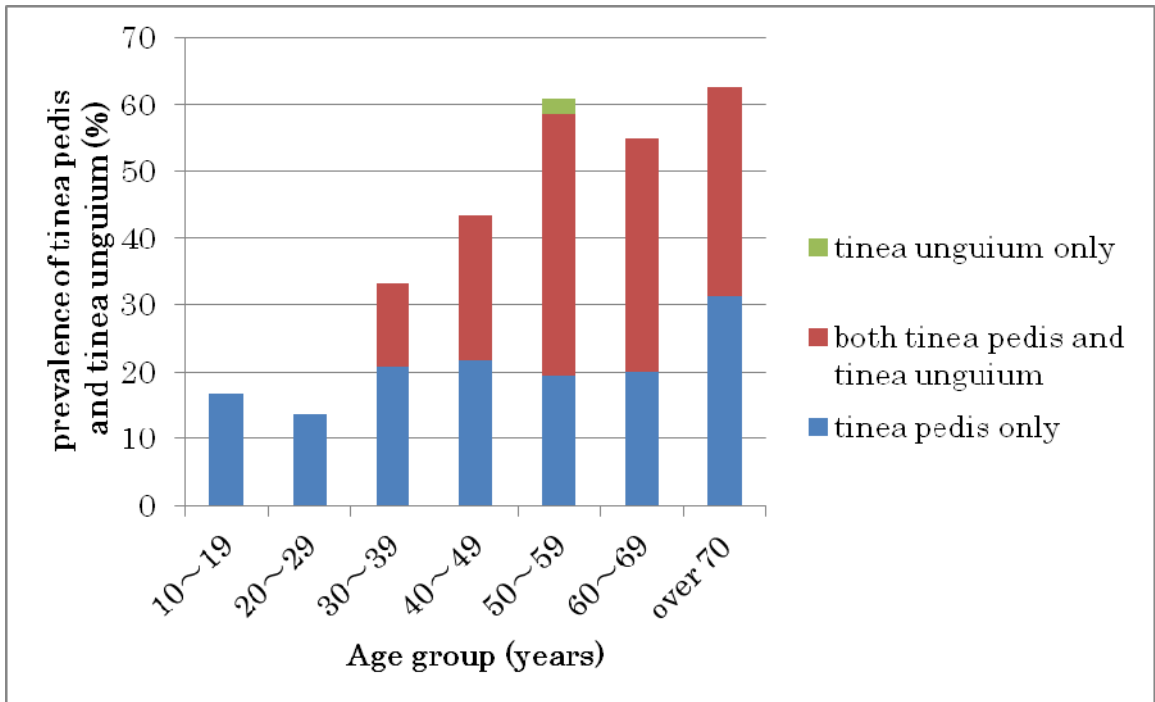


Fig.1-B Age distribution prevalence of tinea pedis and tinea unguium in inpatients with depression

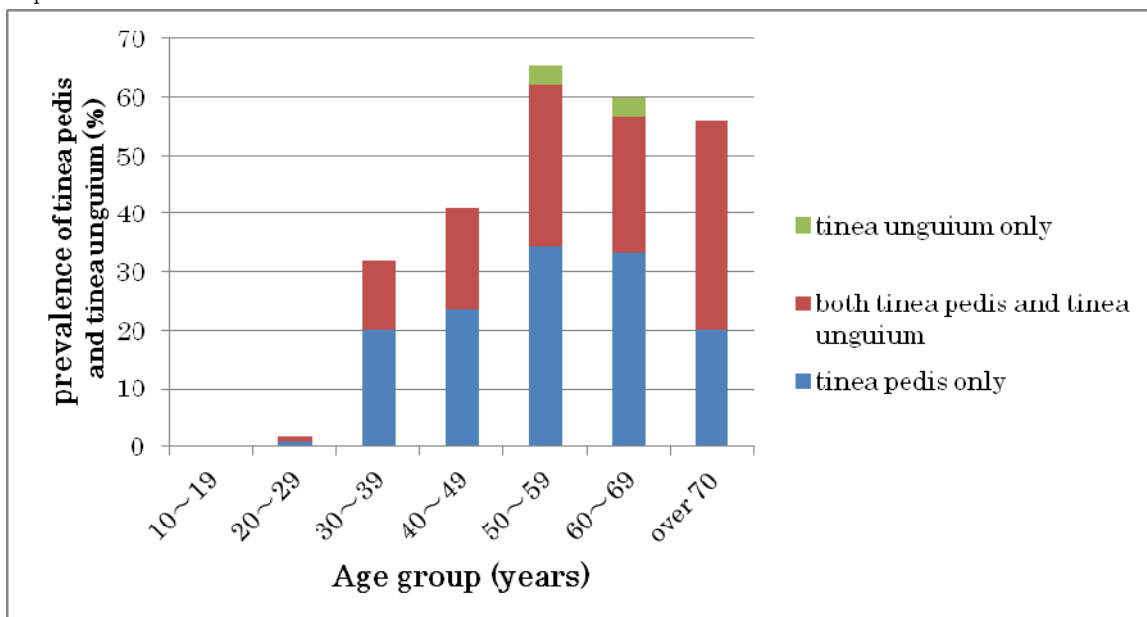


Fig.2 clinical symptom scores

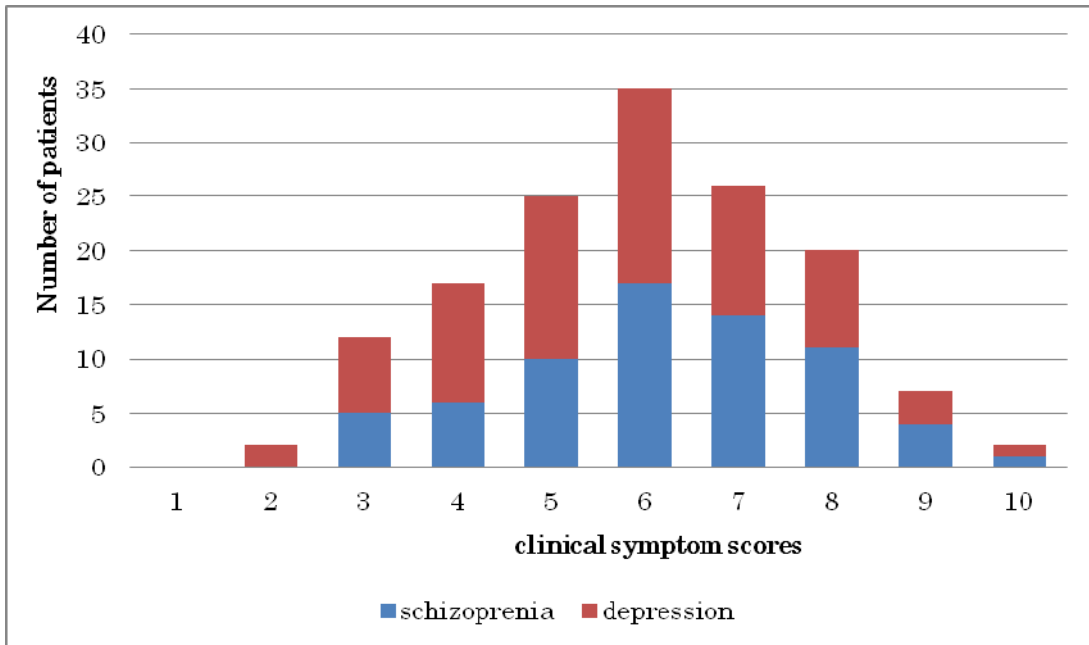


Fig.3 severity score

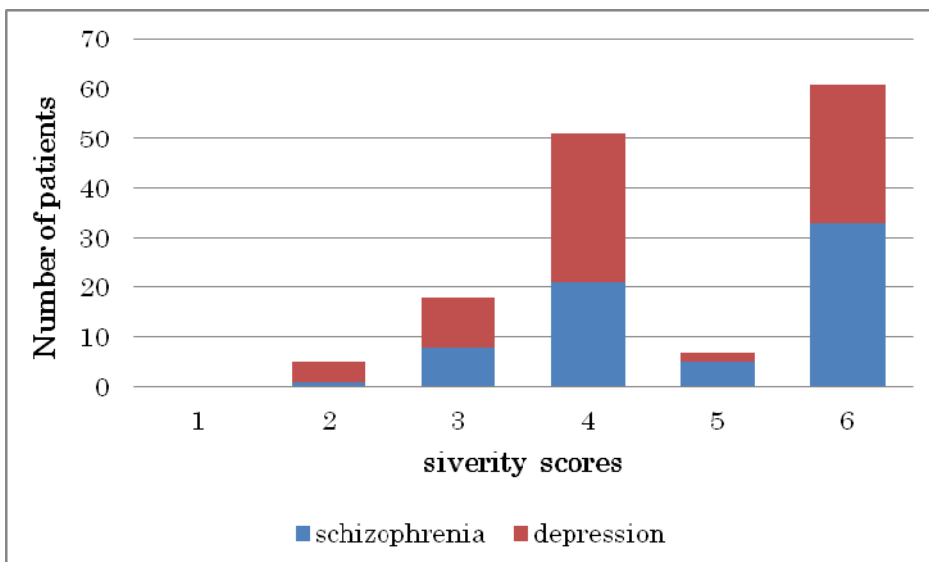




Fig.4. The right foot of a 58-year-old man with schizophrenia showed hyperkeratotic type of tinea pedis. Clinical symptom score 8, severity score 6. *T. rubrum* was isolated.



Fig.5. The feet of a 56-year-old woman with schizophrenia showed hyperkeratotic type of tinea pedis. Clinical symptom score 7, severity score 6. *T. rubrum* was isolated.



Fig.6. The toenails of a 58-year-old man with depression showed DLSO type of tinea unguium. SCI0 score 25. *T.mentagrophytes* was isolated.