Perceptions and Management Practices of Onychomycosis Among Thai Physicians

Pichaya Limphoka, M.D.*, Charussri Leeyaphan, M.D.*, Chudapa Sereeaphinan, M.D.*, Pattriya Chanyachailert, M.D.*, Sumanas Bunyaratavej, M.D.*, Carren Hau, M.D., Ph.D.**

**Department of Dermatology, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok, Thailand, **Section of Dermatology, Department of Internal Medicine, Manila Doctors Hospital, Manila, Philippines.*

ABSTRACT

Objective: To examine the proportion of physicians who conducted mycological laboratory procedures to confirm a diagnosis of onychomycosis. The secondary purpose was to evaluate the practical management of physicians, comparing general practitioners and dermatology-related physicians.

Materials and Methods: This cross-sectional study and questionnaire-based research was conducted during 2021-2022. The questionnaire was composed of questions related to the practical management of onychomycosis, including diagnosis and treatment.

Results: Overall, 143 physicians were recruited to take part in this study. The number of physicians who conducted direct examination with potassium hydroxide was 99 (69.2%). The number of dermatology-related physicians who conducted mycological laboratory examinations to confirm the diagnosis was significantly higher than among general physicians (95.8% vs. 52.2%; p<0.001). Feet examination and determination of poor prognostic factors, such as elderly age, nail thickness, presence of dermatophytoma and nondermatophytes infection, were done by the dermatology-related physicians in significantly higher numbers. Blood testing before starting treatment for onychomycosis with oral antifungal medications seemed to be higher (87.5%) in the dermatology-related group. Moreover, mycological re-evaluation after treatment cessation was more significantly requested by the dermatology-related participants (75% vs. 15.8%, p<0.001).

Conclusion: Laboratory confirmation, feet examination, and the recognition of poor prognostic factors were significantly lower in the general practitioner group. These findings should raise awareness for improving further education about onychomycosis management in medical students, since mycological laboratory examination is crucial for diagnosis and it is helpful in guiding the proper disease management for complete disease remission.

Keywords: Mycological laboratory; general practitioners (Siriraj Med J 2023; 75: 76-84)

INTRODUCTION

Onychomycosis is one of the most common nail diseases worldwide.[1] The prevalence of onychomycosis in the Asian population is approximately 10%.[1] The diagnosis of onychomycosis requires both characteristic clinical manifestations and laboratory investigation.[2] Clinical manifestations that are suggestive of onychomycosis are subungual hyperkeratosis, onycholysis, nail discoloration, or nail dystrophy. However, there are a number of diseases, including chronic trauma, lichen planus, psoriasis, and subungual malignant melanoma, that mimic the features of onychomycosis.[2,3,14] A previous study showed that about 65% of general practitioners misdiagnosed psoriatic nails as onychomycosis.[4] Therefore, laboratory investigations,

Corresponding author: Sumanas Bunyaratavej
E-mail: consultskin@yahoo.com
Received 24 May 2022 Revised 28 June 2022 Accepted 29 June 2022
ORCID ID:http://orcid.org/0000-0002-0852-7742
https://doi.org/10.33192/smj.v75i2.260741

involving either direct microscopic examination with potassium hydroxide or fungal culture, are essential to confirm the diagnosis of onychomycosis. Fungal culture is also beneficial in identifying the specific species of pathogen, and can help physicians to make the correct decision and to adjust the proper treatments to individual patients.[2,5]

The treatment of onychomycosis often requires long-term treatment.[6] Oral antifungal treatments, such as allylamine terbinafine and the triazole group, have potential systemic side effects, such as hepatic involvement.[7,8] Several studies have revealed an inappropriate management of onychomycosis among physicians.[5] For example, a survey in the United Kingdom found that only a small proportion of physicians conducted laboratory confirmation before treating onychomycosis with oral terbinafine.[7] One research study found that only 30% of dermatologists performed laboratory monitoring during oral terbinafine treatment.[5]

The objective of the present study was to determine the proportion of physicians who conducted mycological laboratory examination prior to a diagnosis of onychomycosis. We also aimed to evaluate the practical management of physicians, by comparing general practitioners with dermatology-related physicians.

MATERIALS AND METHODS

Study design

This cross-sectional study was a questionnaire-based research and was conducted during 2021-2022. This study was approved by the Siriraj Institutional Review Board, Faculty of Medicine Siriraj Hospital (COA no. Si 733/2021). The questionnaire was developed and divided into four parts. The initial part aimed to collect the participants' demographic data, including age, sex, marital status, workplace, working experience, and level of confidence in onychomycosis management. The other three parts were: 1) the opinions regarding the laboratory investigation request, covering 5 items; 2) the prognostic evaluation of onychomycosis, covering 10 items; and 3) the knowledge and practice for onychomycosis treatment, covering 6 items. Each variable item was recorded as categorical data. Google Forms was used as a channel to send the questionnaire. The study participants must be physicians who practice in Thailand.

Statistical analysis

Data were analyzed using PASW Statistics for Windows, version 18 (SPSS Inc., Chicago, IL, USA). Descriptive statistics were presented as frequency and percentage. The Chi-square test or Fisher's exact test were used to compare the differences between the general practitioners and dermatology-related participants. A p-value less than 0.05 was considered as statistically significant.

RESULTS

In total, 143 physicians were recruited to participate in the study. Their demographic data are shown in Table 1. Their mean (SD) age was 33.9 (7.8) years old, while the minimum and maximum ages were 21 and 62 years old, respectively. Among the participants, 48 (33.6%) were dermatology-related physicians, comprising 23 (16.1%) who were board-certified dermatologists (16.1%) and 25 (17.5%) who were MSc, diploma, or in-training dermatology residents. Most participants worked in a university-based hospital. The minimum working experience was 1 year, while the maximum was 36 years. Most participants saw 0-5 patients per week (50%) and had low to moderate confidence in skin disease management. Regarding nail disease, 47 (32.9%) participants encountered patients with nail problems in 2-5 cases per year. The majority of participants (41.3%) reported that they had a moderate level of confidence in onychomycosis management.

Table 2 shows the information about onychomycosis diagnosis when comparing the dermatology-related physicians with general practitioners. The proportion of physicians who conducted direct examination with potassium hydroxide was 69.2%. The opinion that laboratory investigations were necessary for onychomycosis diagnosis was significantly higher in the dermatology-related physicians (97.9% vs. 54.7%, $p < 0.001$). In practical management, 30 (62.5%) dermatology-related participants requested laboratory investigations almost or every time, which was significantly higher than for the other group (62.5% vs. 13.7%, $p < 0.001$). The presence of distinct clinical features of onychomycosis were the major cause for not requesting laboratory examinations. The significant reason those general practitioners did not request laboratory examinations to confirm diagnosis was the lack of knowledge of specimen processing ($p < 0.001$). Nail fungal culture was requested significantly more by the dermatology-related participants (79.2% vs. 37.9%, $p < 0.001$). The opinion that fungal culture was necessary was also significantly higher among dermatology-related physicians (89.6% vs. 50.5%, $p < 0.001$).

Table 3 demonstrates the prognostic evaluations of onychomycosis. Most participants had an awareness of poor prognosis factors, especially in the dermatologist-related group. An older age > 70 years old, nail thickness > 2 mm, presence of dermatophytoma and *Neoscytalidium* spp. infection were factors that the dermatology-related

TABLE 1. Demographic data of the participants.

Demographic data	Total physicians n = 143 (%)
Age, years (mean, SD)	33.9 (7.7)
Status	
General practitioner	45 (31.5)
Specialist other than dermatologist	45 (31.5)
MSc, diploma, dermatology resident in training	25 (17.5)
Board-certified dermatologist	23 (16.1)
Other specialists	5 (3.5)
Workplace*	
University hospital	60 (42.0)
General hospital	35 (24.5)
Community hospital	16 (11.2)
Private hospital	31 (21.7)
Private clinic	28(19.6)
Working experience, years (mean, SD)	9.2 (6.9)
Number of skin patients during last one year (patients per week)	
0–5	72 (50.3)
6–15	18 (12.6)
16–30	17 (11.9)
31–50	13 (9.1)
>50	23 (16.1)
Confidence in management of skin disease	
Very low confidence	17 (11.9)
Low confidence	51 (35.7)
Moderate confidence	53 (37.1)
Very high confidence	22 (15.4)
Number of patients with nail diseases during last one year (patients per year)	
0–1	25 (17.5)
2–5	47 (32.9)
6–10	22 (15.4)
11–40	34 (23.8)
>40	15 (10.5)
Confidence in management of nail disease	
Very low confidence	30 (21.0)
Low confidence	48 (33.6)
Moderate confidence	59 (41.3)
Very high confidence	6 (4.2)

*One physician could have more than one workplace.
Abbreviation: SD, standard deviation

TABLE 2. Comparison of the proportion between Thai general practitioners and dermatologic-related physicians regarding requesting laboratory investigations for onychomycosis diagnosis and treatment.

Items	Overall n = 143 (%)	Thai general practitioners n = 95 (%)	Dermatology-related physicians n = 48 (%)	P-value
Opinion regarding the necessity of requesting laboratory investigations of nail specimens for diagnosis				<0.001*
Not necessary	44 (30.8)	43 (45.3)	1 (2.1)	
Necessary	99 (69.2)	52 (54.7)	47 (97.9)	
Requesting laboratory investigation of nail specimens before starting treatment				<0.001*
Never	47 (32.9)	45 (47.4)	2 (4.2)	
Less than half of cases	38 (26.6)	31 (32.6)	7 (14.6)	
More than half of cases	15 (10.5)	6 (6.3)	9 (18.8)	
Almost or every time	43 (30.1)	13 (13.7)	30 (62.5)	
Reasons for not requesting laboratory investigations of nail specimens before starting treatment[a,b]	**n = 100**	**n = 82**	**n = 18**	
Distinct clinical manifestations	64 (64.0)	51 (62.2)	13 (72.2)	0.422
Unapproachable to available laboratory	56 (56.0)	48 (58.5)	8 (44.4)	0.275
Lack of knowledge in specimen processing	39 (39.0)	38 (46.3)	1 (5.6)	0.001*
Long turnaround time	38 (38.0)	30 (36.6)	8 (44.4)	0.534
Patients' financial problems	14 (14.0)	9 (11.0)	5 (27.8)	0.125
Investigations requested by physicians for onychomycosis diagnosis and treatment[a]				
Direct KOH examination	136 (95.1)	89 (93.7)	47 (97.9)	0.424
Nail fungal culture	74 (51.7)	36 (37.9)	38 (79.2)	<0.001*
Nail pathology	32 (22.4)	17 (17.9)	15 (31.3)	0.070
Molecular testing	2 (1.4)	2 (2.1)	0	0.551
Opinion regarding necessity of fungal culture				<0.001*
Necessary	91 (63.6)	48 (50.5)	43 (89.6)	
Not necessary	52 (36.4)	47 (49.5)	5 (10.4)	

*A p-value less than 0.05 indicated statistical significance, Chi-squared test.

[a]One physician could have more than one reason for not requesting laboratory investigations or one investigation that could be requested for the diagnosis and treatment of onychomycosis.

[b]Some participants responded to the questionaries in this topic.

TABLE 3. Prognostic evaluation of onychomycosis.

Questions	Overall n = 143 (%)	Thai general practitioners n = 95 (%)	Dermatology-related physicians n = 48 (%)	P-value
Expectation of nail condition after complete treatment				0.446
Normal or near normal	69 (48.3)	43 (45.3)	26 (54.2)	
Improved but not normal	72 (50.3)	50 (52.6)	22 (45.8)	
Stable or worse	2 (1.4)	2 (2.1)	0	
Awareness of poor prognostic factors				<0.001*
No	29 (20.3)	29 (30.5)	0	
Yes	114 (79.7)	66 (69.5)	48 (100.0)	
What are the prognostic factors?[a]	**n = 144**	**n = 66**	**n = 48**	
Peripheral vascular disease	97 (85.1)	57 (86.4)	40 (83.3)	0.654
Age > 70 years old	88 (77.2)	46 (69.7)	42 (87.5)	0.025*
Area involvement > 2/3	86 (75.4)	50 (75.8)	36 (75.0)	0.926
Nail thickness > 2 mm	84 (73.7)	44 (66.7)	40 (83.3)	0.046*
Dermatophytoma	67 (58.8)	28 (42.4)	39 (81.3)	<0.001*
Neoscytalidium spp. infection	61 (53.5)	24 (36.4)	37 (77.1)	<0.001*
Lateral nail fungal infection	51 (44.7)	26 (39.4)	25 (52.1)	0.179
Distal nail fungal infection	21 (18.4)	15 (22.7)	6 (12.5)	0.164
Do they know NDM?				<0.001*
Not know	39 (27.3)	39 (41.1)	0	
Not sure	37 (25.9)	31 (32.6)	6 (12.5)	
Know	67 (46.9)	25 (26.3)	42 (87.5)	
How often do they do foot examination?				<0.001*
Never	20 (14.0)	20 (21.1)	0	
Less than half of cases	44 (30.8)	40 (42.1)	4 (8.3)	
More than half of cases	25 (17.5)	20 (21.1)	5 (10.4)	
Almost or every time	54 (37.8)	15 (15.8)	39 (81.3)	
How often do they do examine for peripheral vascular disease?				0.047*
Never	68 (47.6)	52 (54.7)	16 (33.3)	
Less than half of cases	43 (30.1)	27 (28.4)	16 (33.3)	
More than half of cases	24 (16.8)	13 (13.7)	11 (22.9)	
Almost or every time	8 (5.6)	3 (3.2)	5 (10.4)	
How often do they do measure nail thickness?				<0.001*
Never	75 (52.4)	64 (67.4)	11 (22.9)	
Less than half of cases	38 (26.6)	25 (26.3)	13 (27.1)	
More than half of cases	13 (9.1)	3 (3.2)	10 (20.8)	
Almost or every time	17 (11.9)	3 (3.2)	14 (29.2)	

TABLE 3. Prognostic evaluation of onychomycosis. (Continued)

Questions	Overall n = 143 (%)	Thai general practitioners n = 95 (%)	Dermatology-related physicians n = 48 (%)	P-value
Opinion regarding importance of requesting laboratory investigations of nail specimens after treatment				0.012*
Not important	9 (6.3)	6 (6.3)	3 (6.3)	
Not sure	47 (32.9)	39 (41.1)	8 (16.7)	
Important	87 (60.8)	50 (52.6)	37 (77.1)	
How often do they request laboratory investigations of nail specimens after complete treatment?				
Never	92 (64.3)	80 (84.2)	12 (25.0)	<0.001*
Less than half of cases	24 (16.8)	9 (9.5)	15 (31.3)	
More than half of cases	10 (7.0)	2 (2.1)	8 (16.7)	
Almost or every time	17 (11.9)	4 (4.2)	13 (27.1)	
How often do they request blood testing before prescribing oral antifungal drugs?				0.130
Never	32 (22.4)	26 (27.4)	6 (12.5)	
Less than half of cases	28 (19.6)	20 (21.1)	8 (16.7)	
More than half of cases	25 (17.5)	14 (14.7)	11 (22.9)	
Almost or every time	58 (40.6)	35 (36.8)	23 (47.9)	

*A p-value less than 0.05 indicated statistical significance, Chi-squared test.

[a]One physician could consider more than one factor to be a prognostic factor.

participants significantly had more awareness of ($p < 0.001$). *Neoscytalidium* spp. was significantly more well known in the dermatology-related group (87.5% vs. 26.3%, $p < 0.001$). Feet examination was significantly done every time by the dermatology-related participants (81.3%, $p < 0.001$). Among the general practitioners, nail thickness measurement and laboratory request after treatment were less frequently done ($p < 0.001$). Before starting treatment for onychomycosis with oral antifungal agents, blood testing seemed to be more frequently ordered in the dermatology-related group.

Treatment of the onychomycosis aspects are shown in Table 4. The use of topical therapy was significantly higher in the dermatology-related group (81.3% vs. 34.7%, $p < 0.001$). Also, 41.7% of the dermatology-related group participants used oral antifungal agents almost or every time. Most participants did not agree with surgical nail avulsion as a treatment option. However, the indications for surgical nail avulsion were not recognized in the non-dermatology-related group (70.5%). Chemical nail avulsion was used significantly more by the dermatology-related participants (62.5% vs. 3.2%, $p < 0.001$).

DISCUSSION

The results provide interesting information about onychomycosis practice in Thailand. Most participants in this survey had encountered only a small number of patients suspected of onychomycosis. However, almost half of the participants had a moderate level of confidence in managing onychomycosis.

We found that nearly all the dermatology-related physicians used laboratory investigations to confirm

TABLE 4. Knowledge and practice for onychomycosis treatment.

Questions	Overall n = 143 (%)	Thai general practitioners n = 95 (%)	Dermatology-related physicians n = 48 (%)	P-value
Role of topical therapy for onychomycosis				<0.001*
Not know	30 (21.0)	29 (30.5)	1 (2.1)	
Know but never use	41 (28.7)	33 (34.7)	8 (16.7)	
Know and used to treat with topical therapy	72 (50.3)	33 (34.7)	39 (81.3)	
Experience in treating onychomycosis with oral antifungal medication				0.002*
Never	21 (14.7)	20 (21.1)	1 (2.1)	
Less than half of cases	41 (28.7)	31 (32.6)	10 (20.8)	
More than half of cases	37 (25.9)	20 (21.1)	17 (35.4)	
Almost or every time	44 (30.8)	24 (25.3)	20 (41.7)	
Opinion regarding roles of surgical nail avulsion in treatment				<0.001*
Not agree	108 (75.5)	63 (66.3)	45 (93.8)	
Not sure	30 (21.0)	28 (29.5)	2 (4.2)	
Agree	5 (3.5)	4 (4.2)	1 (2.1)	
Indications for surgical nail avulsion				<0.001*
Not know	79 (55.2)	67 (70.5)	12 (25.0)	
Know but never use	51 (35.7)	23 (24.2)	28 (58.3)	
Know and used to treat patient with surgical nail avulsion	13 (9.1)	5 (5.3)	8 (16.7)	
Role of chemical nail avulsion for onychomycosis				<0.001*
Not know	66 (46.2)	65 (68.4)	1 (2.1)	
Know but never use	44 (30.8)	27 (28.4)	17 (35.4)	
Know and used to treat patient with chemical avulsion	33 (23.1)	3 (3.2)	30 (62.5)	
Role of partial nail avulsion for onychomycosis				<0.001*
Not know	62 (43.4)	58 (61.1)	4 (8.3)	
Know but never use	65 (45.5)	30 (31.6)	35 (72.9)	
Know and used to treat patient with partial nail avulsion	16 (11.2)	7 (7.4)	8 (18.8)	

*A p-value less than 0.05 indicated statistical significance, Chi-squared test.

the diagnosis, which was consistent with the result of a study in Canada.[9] Unfortunately, almost half of the general practitioners never used mycological laboratory examinations to confirm the diagnosis of onychomycosis. These results were similar to several studies that reported that general practitioners tended to treat onychomycosis without the mycological evidence of fungal infection[5,6] This study showed that the most common reason for not performing mycological laboratory examinations was the belief that the clinical manifestations were sufficient for diagnosis. Nevertheless, the lack of knowledge in specimen processing was found to be significantly different between the two groups. More than half of the participants conducted fungal culture. However, the proportion who conducted fungal culture was significantly higher among the dermatology-related physicians. This emphasized that knowledge played a key role in onychomycosis management. In addition, this study revealed that the second most-common reason for general practitioners not to perform mycological investigations was the lack of accessibility to laboratory facilities. Therefore, easily accessible mycological laboratory facilities may motivate physicians to use mycological investigations to confirm the diagnosis. Several studies also demonstrated other reasons, such as general practitioners had insufficient skills or it was time-consuming to collect specimens, or they felt familiar through previous individual practice.[5,9]

Cases of concurrent onychomycosis and tinea pedis were also reported.[10] Our study revealed that a significantly lower number of general practitioners did feet examination compared to the dermatology-related physicians. Examination of the feet was recommended in patients diagnosed with onychomycosis, since tinea pedis could be reservoirs of infection, resulting in unsuccessful treatment.[10] Poor prognostic factors, including elderly age, longer onset, presence of cardiovascular diseases, widespread dermatophyte infection, and multiple nail infection, were found to be associated with a poorer outcome.[11,12] In this study, the poor prognostic factors that were significantly underrecognized by the general practitioners were an elderly age, subungual hyperkeratosis (>2 mm), presence of dermatophytoma, and NDM infection. Greater education for general practitioners to recognize the prognostic factors would result in a better treatment outcome.[12]

According to the results from this study, oral antifungal drugs were often used by dermatology-related physicians more than by general practitioners. This study showed the same percentage of general practitioners who never used oral antifungal drugs as a treatment option.[7] Almost half of the physicians performed blood tests before starting oral antifungal agents, but the proportion was not statistically significant between the two groups. Oral terbinafine is an effective drug in treating dermatophyte onychomycosis. However, terbinafine is expensive and can cause adverse side effects, such as hepatic involvement (elevated hepatic enzymes).[5] It is thus recommended that oral antifungal agents should be prescribed only when physicians see characteristic clinical manifestations and when mycological laboratory examinations confirm the diagnosis of onychomycosis.[5,7] Our study showed that the percentage of general practitioners who never conducted blood testing prior to prescribing oral antifungal agents was 27.4%. This proportion was lower compared to a previous study that showed 36% of general practitioners had never done a blood test.[7] Blood testing for complete blood count and liver function prior to starting oral antifungals was suggested by some experts.[6] Monitoring the laboratory results during treatment with oral antifungal drugs is still controversial. Unsurprisingly, in one study it was found that the percentage of dermatologists who monitored blood tests during using oral antifungal therapy was only 30%.[9] Some authors suggested that the careful monitoring of blood testing is recommended in patients with underlying hepatic disease.[6]

The opinion regarding performing follow-up laboratory examination after the cessation of treatment was significantly higher in the dermatology-related group. When practicing, almost all the general practitioners never performed laboratory investigations after the completion of treatment. The reasons for this were that they may perform mycological investigations only in cases with no response or in suboptimal treatment or recurrent disease cases.[6,7]

A 43-year retrospective study of lawsuits involving nail conditions in the United States found that the most common reason was inadequate treatment causing undesirable sequalae, which was found in 19 cases (51%).[13] Unfortunately, misdiagnosis leading to a serious issue was the major reason why lawsuits were won by the plaintiff.[13]

In conclusion, the laboratory confirmation of onychomycosis was significantly lower in the general practitioner group. However, in all cases of suspected onychomycosis, mycological laboratory examinations to confirm the diagnosis are crucial.[6,7,14] A clear guideline for onychomycosis management and concrete evidence supporting mycological laboratory examinations as essential for onychomycosis diagnosis may be helpful to guide the proper management.[7] Laboratory investigations prior and during the administration of oral antifungal drugs are still inconclusive. Further studies about the benefits and cost

effectiveness are needed. Easily accessible mycological laboratory facilities will also motivate physicians to conduct proper investigations. This study also emphasizes that education is important for all physicians in order to ensure they can provide the proper management of onychomycosis, reduce adverse events, and provide the best care for patients.

Conflict of interests: All authors have no conflicts of interest or financial support to declare.

Funding: None

REFERENCES

1. Sigurgeirsson B, Baran R. The prevalence of onychomycosis in the global population: a literature study. J Eur Acad Dermatol Venereol. 2014;28(11):1480-91.
2. Ameen M, Lear JT, Madan V, Mohd Mustapa MF, Richardson M. British Association of Dermatologists' guidelines for the management of onychomycosis 2014. Br J Dermatol. 2014; 171(5):937-58.
3. Denning DW, Evans EG, Kibbler CC, Richardson MD, Roberts MM, Rogers TR, et al. Fungal nail disease: a guide to good practice (report of a Working Group of the British Society for Medical Mycology). BMJ. 1995;311(7015):1277-81.
4. Bunyaratavej S, Prasertworonun N, Chaiwanon O, Pattanaprichakul P. Alarming trend towards deviation of clinical diagnosis and management of psoriatic nails by Thai general practitioners and non-dermatologist specialists. J Eur Acad Dermatol Venereol. 2015;29(2):398-9.
5. Wilcock M, Hartley J, Gould D. Inappropriate use of oral terbinafine in family practice. Pharm World Sci. 2003;25(1): 25-6.
6. Gupta AK, Mays RR, Versteeg SG, Piraccini BM, Takwale A, Shemer A, et al. Global perspectives for the management of onychomycosis. Int J Dermatol. 2019;58(10):1118-29.
7. Lasseter G, McNulty CA, Palmer M, Yoxall H, Kibbler C, Health Protection Agency GPMLUG. Developing best practice for fungal specimen submission--fungal audit of general practice. Mycoses. 2012;55(6):476-82.
8. Wharry S. FDA issues warnings about drugs used to treat fungal nail infections. CMAJ. 2001;164(12):1738.
9. Gupta AK, Shear NH. A questionnaire study on the management of onychomycosis: a Canadian perspective. Int J Dermatol. 1998;37(6):457-60.
10. Walling HW. Subclinical onychomycosis is associated with tinea pedis. Br J Dermatol. 2009;161(4):746-9.
11. Loo DS. Onychomycosis in the elderly: drug treatment options. Drugs Aging. 2007;24(4):293-302.
12. Widaty S, Miranda E, Bramono K, Menaldi SL, Marissa M, Oktarina C, et al. Prognostic factors influencing the treatment outcome of onychomycosis Candida. Mycoses. 2020;63(1):71-7.
13. Xiang L, Lipner SR. Characteristics of malpractice lawsuits involving nail disorders in the United States from 1977 to 2019. J Am Acad Dermatol. 2020;83(4):1202-4.
14. Leeyaphan C, Bunyaratavej S, Chadchavalpanichaya N, Rujitharanawong C, Phaitoonwattanakij S, Matthapan L. Clinical and Laboratory Findings in Trauma-Induced Nail Dystrophy versus Onychomycosis. Siriraj Med J. 2018;70(6): 490-5.