Original paper

The prevalence and etiological factors of onychomycosis in psoriatic patients

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Adv Dermatol Allergol 2018; XXXV (3): 309–313
DOI: https://doi.org/10.5114/pdia.2017.68299

Abstract

Introduction: The role of a number of inherited, acquired and environmental factors has been identified to increase the risk of onychomycosis. The literature data on psoriasis as a risk factor are contradictory. The potential relationship between these pathologies is very important as it influences the patient management.

Aim: To evaluate the frequency of onychomycosis and etiological factors in patients with psoriasis compared to controls.

Material and methods: The studied group (n = 2427) included 2325 patients with nail abnormalities raising a clinical suspicion of nail onychomycosis (with no history of psoriasis) and 102 psoriatic inpatients. The control group included 100 patients with clinically normal nails. The assessment of psoriasis severity using Nail Psoriasis Severity Index (NAPSI) and Psoriasis Area and Severity Index (PASI) was performed in all psoriatic patients. The presence of fungi was confirmed in direct microscopy and culture.

Results: A significantly higher incidence of onychomycosis was observed in psoriatic patients as well as in non-psoriatic patients with clinically abnormal nails compared to controls. The prevalence of onychomycosis did not differ significantly between psoriatic patients and non-psoriatic patients with nail alterations. The characteristics of isolated fungi differed significantly between psoriatic and non-psoriatic patients. NAPSI ≥ 40 and receiving systemic treatment increased the risk of onychomycosis in psoriatic patients.

Conclusions: The presented study showed a relatively high prevalence of onychomycosis in patients with psoriasis, what confirms the accuracy of performing screening mycological examination in this group. Further studies are warranted to evaluate the role of specific risk factors, explain the differences observed in previous studies and to determine optimal patient management.

Key words: onychomycosis, psoriasis, fungal nail infections.

Introduction

Onychomycosis is the most common pathology affecting the nail apparatus. Data on its prevalence differ between European countries and range from 2.7% to 8.4% [1–4]. In the Achilles study conducted in 16 European countries (n = 9600), the presence of toenail onychomycosis was assessed to be as high as 29.6% [5].

The role of a number of inherited, acquired and environmental factors has been identified to increase the risk of onychomycosis. Some author claim that psoriasis in an important risk factor.

Psoriasis is a chronic dermatological disease that affects 2–3% of the general population and the lifetime nail involvement is estimated to be up to 80% [6–8]. Morphological abnormalities in psoriatic nails may facilitate the fungal invasion. On the other hand, faster turnover of the nail plate should be a protective factor.

Epidemiological studies conducted so far provide ambiguous results. Some authors indicate that onychomycosis may affect up to 79% of psoriatic patients, the others show a low incidence of onychomycosis (15%) in this group.

From the clinical point of view, the potential relationship between these pathologies is very important as it influences the patient management. The presence of undetected and untreated fungi in the nail plate may increase the severity of nail psoriasis (Köbner phenomenon) and be the cause of the treatment failure.

Another questionable issue is the spectrum of causative fungi responsible for onychomycosis in psoriatics. There are some data suggesting that onychomycosis in

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Received: 9.03.2017, **accepted:** 4.05.2017.

psoriatic patients is more commonly caused by yeasts than in non-psoriatics [9–12], although significant differences have been noted depending on the population studied.

In the light of inconsistent findings, conducting future studies concerning this relevant issue is mandatory. We decided to assess the prevalence and etiological factors for onychomycosis in psoriatic patients from the Northern Polish population.

Aim

The aim of the study was: (1) to evaluate the prevalence of nail onychomycosis in psoriatic patients; (2) to define the causative agents identified in microscopic examination and culture; (3) to investigate the relationship between the severity of nail psoriasis and onychomycosis; (4) to assess the relationship between currently administered psoriasis treatment and the prevalence of onychomycosis.

Material and methods

The studied group (n = 2427) included 2325 patients with nail abnormalities raising a clinical suspicion of nail onychomycosis (with no history of psoriasis) referred to mycological laboratory and 102 psoriatic inpatients hospitalized in the Department of Dermatology between 2014 and 2016.

Nail abnormalities in non-psoriatic group included onycholysis, pachyonychia, subungual hyperkeratosis, onychorrhexis, chromonychia and onychodystrophy.

In the psoriatic group we observed nail alterations connected with matrix as well as with the nail bed involvement. The former included pitting, leukonychia, onychorrhexis and dystrophy. The latter included onycholysis, subungual hyperkeratosis and "oil drop" sign. The control group included 100 patients with no chronic dermatological disorders in whom we randomly detected some nail changes (onycholysis, chromonychia, nail fragility) during routine nevi assessment (n = 20).The assessment of psoriasis severity using (Nail Psoriasis Severity Index (NAPSI) and Psoriasis Area and Severity Index (PASI) was performed in all psoriatic patients.

The presence of fungi was confirmed in direct microscopic examination (with dimethyl sulfoxide) and mycological culture. Each sample obtained with the sterile lancet was cultured on Sabouraud dextrose agar with chloramphenicol and gentamicin with and without cycloheximide at room temperature for 4 weeks. Dermatophytes and molds were identified based on macroscopic and microscopic colony evaluation. Yeasts were identified using biochemical methods. A result was considered positive only when both direct microscopic examination and mycological culture were positive.

Statistical analysis

The χ^2 analysis was employed to test the significance of the differences between groups. Analyses were performed using the Statistica 12.0 software package (StatSoft, Inc., 2015). $P < 0.05$ was considered statistically significant.

Results

The prevalence of onychomycosis in the studied groups is presented in Table 1. Statistical analysis revealed a significantly higher prevalence of onychomycosis in psoriatic patients and in non-psoriatic patients with structural nail alterations referred to mycological laboratory compared to controls (23.53% vs. 5%; $p = 0.0004$ and 22.37% vs. 5%; $p < 0.0001$, respectively).

The prevalence of onychomycosis did not differ significantly between psoriatic patients and non-psoriatic patients with nail alterations ($p = 0.88$).

The characteristics of the isolated fungi is presented in Table 2. Molds were significantly more prevalent factors of onychomycosis in psoriatic than in non-psoriatic patients ($p = 0.003$). Detailed descriptions of identified pathogens are presented in Table 3.

The frequency of onychomycosis was higher in psoriatic patients with NAPSI ≥ 40 (66.67% vs. 33.33%; $p = 0.02$). On the other hand, there was no correlation between PASI score and the prevalence of onychomycosis (Table 4).

Nail fungal infections were more common in psoriatic patients receiving systemic treatment compared to these treated exclusively with topical agents (75% vs. 25% respectively; $p = 0.005$) (Table 3).

Table 1. The prevalence of onychomycosis in the study group and controls. A significantly higher incidence of onychomycosis was observed in psoriatic patients as well as in non-psoriatic patients with clinically abnormal nails referred to mycological laboratory compared to controls (23.53% vs. 5%; $p = 0.0004$ and 22.37% vs. 5%; $p < 0.0001$)

Group	Onychomycosis *n* (%)	Fingernail onychomycosis *n* (%)	Toenail onychomycosis *n* (%)
Control group (n = 100)	5 (5)	1 (20.00)	4 (80.00)
Non-psoriatic patients with abnormal nails (n = 2325)	520 (22.37)	168 (32.31)	352 (67.69)
Psoriatic patients with abnormal nails (n =102)	24 (23.53)	12 (50.00)	12 (50.00)

Table 2. The characteristics of isolated fungi in the study group. Higher prevalence of yeasts and molds in psoriatic patients ($p = 0.46$ and $p = 0.003$, respectively). Higher prevalence of dermatophytes in non-psoriatic patients ($p = 0.02$)

Isolated fungi	Psoriatic patients with abnormal nails with positive mycological examination *n* (%)	Non-psoriatic patients with abnormal nails with positive mycological examination *n* (%)
Yeasts	12 (50.00)	220 (42.31)
Dermatophytes	7 (29.17)	278 (53.46)
Molds	5 (20.83)	22 (4.23)

Table 3. Detailed description of identified pathogens

Group of fungi	Causative agents	Psoriasis and onychomycosis, *n* (%)		Onychomycosis in non-psoriatic patients with abnormal nails, *n* (%)	
		Hands	Feet	Hands	Feet
Yeasts	*Candida albicans*	4 (3.92)	0 (0.00)	131 (5.64)	39 (1.68)
	Candida glabrata	4 (3.92)	0 (0.00)	14 (0.60)	7 (0.30)
	Candida krusei	2 (1.96)	0 (0.00)	14 (0.60)	1 (0.04)
	Geotrichum candidum	2 (1.96)	0 (0.00)	0 (0.00)	8 (0.04)
	Candida tropicalis	0 (0.00)	0 (0.00)	1 (0.04)	0 (0.00)
	Rhodotorula rubra	0 (0.00)	0 (0.00)	0 (0.00)	5 (0.22)
Dermatophytes	*Trichophyton rubrum*	0 (0.00)	4 (3.92)	3 (0.13)	159 (0.22)
	Trichophyton mentagrophytes var. granulosum	0 (0.00)	3 (2.94)	5 (2.98)	108 (4.65)
	Trichophyton mentagrophytes var. interdigitale	0 (0.00)	0 (0.00)	0 (0.00)	1 (0.04)
	Microsporum canis	0 (0.00)	0 (0.00)	0 (0.00)	2 (0.09)
Molds	*Scopulariopsis brevicaulis*	0 (0.00)	5 (4.90)	0 (0.00)	12 (0.52)
	Cladosporium sp.	0 (0.00)	0 (0.00)	0 (0.00)	6 (0.26)
	Alternaria alternata	0 (0.00)	0 (0.00)	0 (0.00)	2 (0.09)
	Fusarium	0 (0.00)	0 (0.00)	0 (0.00)	1 (0.04)
	Aspergillus fumigatus	0 (0.00)	0 (0.00)	0 (0.00)	1 (0.04)

Discussion

The presented study showed a relatively high prevalence (23.53%) of onychomycosis in patients with psoriasis. Nonetheless, the literature data on this issue are contradictory. A higher incidence of onychomycosis in psoriatic patients was observed by Leibovici *et al.* (47.6%) [13], Sánchez-Regana *et al.* (30%) [14] and Larsen *et al.* (27.8%) [10]. A lower incidence was described by Salomon *et al.* (18%) [15], Kaçar *et al.* (13.1%) [16] and Staberg *et al.* (13%) [17]. These data confirm the accuracy of performing screening mycological examination in patients with psoriasis.

The increased prevalence of onychomycosis in psoriatic patients in the studied group supports the hypothesis that the psoriasis is a risk factor for onychomycosis. On the other hand, the 5% prevalence of onychomycosis in the controls requires a critical approach to this conclusion.

Despite similar prevalence results obtained in Great Britain, Spain and Finland (2.7%, 2.6% and 8.4%, respectively) it seems to be low compared to Achilles study (29.6%) [2–5].

The pathogenesis of onychomycosis in psoriatic patients is not completely understood. Some authors claim that primary nail alterations which occur in the course of psoriasis may facilitate fungal infection [18]. On the other hand, increased release of human anti-microbial peptides, such as human cathelicidin LL-37, as well as faster nail growth observed in psoriatics, act as protective factors [19–21]. Another factor affecting the prevalence of onychomycosis in these patients is recommended systemic treatment. The potential risk of fungal infection is probably the combination of the above factors.

The characteristics of isolated fungi differed in psoriatic and non-psoriatic group (Table 2).

Table 4. Clinical characteristics of the psoriatic group with positive mycological examination

Parameter	Number of patients *n* (%)
Gender:	
Female	10 (41.67)
Male	14 (58.33)
Psoriasis type:	
1	15 (62.50)
2	9 (37.50)
Severity of psoriasis:	
NAPSI < 40	8 (33.33)
NAPSI ≥ 40	16 (66.67)
PASI < 15	9 (37.50)
PASI ≥ 15	15 (62.50)
Treatment:	
Topical	6 (25.00)
Systemic treatment including:	18 (75.00)
Acitretin	1 (4.12)
Cyclosporine	3 (12.5)
Methotrexate	5 (20.84)
TNF-α inhibitors (infliximab, etanercept, adalimumab)	9 (37.5)
Additional predisposing factors	15 (62.50)
No additional predisposing factors	9 (37.50)

Statistically significant correlation between the severity of nail alterations (NAPSI ≥ 40) and the prevalence of fungal nail infections (66.67% vs. 33.33%; p = 0.02). Statistically higher prevalence of onychomycosis in psoriatic patients treated with systemic drugs compared to patients on topical treatment.

In psoriatics the most common etiological factors were yeasts, followed by dermatophytes and molds. A similar profile of isolated fungi in psoriatics was previously described by Larsen *et al.* [10] and Ständer *et al.* [22].

Molds were identified significantly more often in the psoriatic group compared to non-psoriatics, which is consistent with the previous study conducted by Leibovici *et al.* [13].

Yeasts were identified more often in the psoriatic group compared to non-psoriatics (although with no statistical significance). The higher prevalence of yeast in psoriatics was previously shown by Ständer *et al.* [22], Larsen *et al.* [10] and Staberg *et al.* [17].

Our study showed a positive correlation between the severity of nail alterations (NAPSI) and the prevalence of dermatophyte nail infections, which is in line with the study conducted by Kaçar *et al.* [16]. Some authors claim that onychomycosis may worsen nail psoriasis by inducing Köbner phenomenon. On the other hand, assessing the NAPSI score in psoriatic patients affected by onychomycosis may not be reliable as clinical symptoms of these two conditions may overlap [16, 23].

To the best of our knowledge, this is the second study which assessed the risk of onychomycosis with respect to PASI. Our results show no relationship between these two variables.

Other factors influencing the frequency of onychomycosis in the studied group were administered treatment modalities. In the present study, patients receiving systemic treatment were statistically more often affected by onychomycosis. Nevertheless, the specificity of the studied group (mostly patients with moderate to severe psoriasis hospitalized and receiving systemic treatment, including TNF-α inhibitors) could affect the results.

Previous studies indicated an increased prevalence of onychomycosis in patients after kidney transplantation receiving cyclosporine compared to healthy controls [8, 24]. Additionally, the results of a randomized prospective study conducted by Al-Mutairi *et al.* [25] showed a higher prevalence of onychomycosis in psoriatic patients treated with etanercept, infliximab and adalimumab (20.3%) compared to individuals treated with different modalities (13.89%). The highest prevalence of fungal nail infections was associated with infliximab treatment.

Conclusions

The present study showed a similar prevalence of onychomycosis in psoriatic patients and non-psoriatic patients with nail alterations referred to mycological laboratory. The characteristics of isolated fungi differed significantly between psoriatic and non-psoriatic patients. NAPSI ≥ 40 and receiving systemic treatment increased the risk of onychomycosis in psoriatic patients. These results are consistent with some previous reports, however this study does not solve all problems and further studies are needed. To the best of our knowledge, this is the second study which assessed the risk of onychomycosis with respect to PASI. Additionally, it provided new epidemiological data on the Northern Polish population.

Conflict of interest

The authors declare no conflict of interest.

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