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## Clinical and Laboratory Investigations

# Pedal dermatophyte infection in psoriasis

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### Summary

**Background** Dermatophyte infections have been considered rare in psoriasis. However, there are data indicating that tinea unguium is as common or even more common in psoriasis compared with healthy controls. Tinea unguium is generally a secondary event to tinea pedis infection.

**Objectives** To study the prevalence of tinea pedis and tinea unguium in psoriasis compared with a control group.

**Methods** Consecutive psoriasis outpatients aged 18–64 years attending a department of dermatology were examined. Samples for direct microscopy and culture were taken from the interdigital spaces, soles and toenails. Consecutive patients without signs of psoriasis or atopic dermatitis seeking examination of moles constituted the control group.

**Results** In total, 239 patients with psoriasis and 245 control patients were studied. The prevalence of tinea pedis was 8.8% [95% confidence interval (CI)  $\pm$  3.6%] in the psoriasis group and 7.8% (95% CI  $\pm$  3.4%) in the control group. The corresponding figures for prevalence of tinea unguium were 4.6% (95% CI  $\pm$  2.7%) and 2.4% (95% CI  $\pm$  1.9%), respectively. The differences found in the psoriasis vs. the control groups were not statistically significant.

**Conclusions** This study does not support the hypothesis that the prevalence of tinea pedis and tinea unguium in patients with psoriasis differs from that in a normal population.

**Key words:** onychomycosis, psoriasis, tinea pedis

Tinea pedis has a strong tendency to evolve into a chronic disease that later might be complicated by the involvement of other areas of the body, e.g. the palms and/or the nails. The infection is often asymptomatic, generally not causing concern until the development of a nail disease, tinea unguium. Exposure to the offending agent, most often *Trichophyton rubrum*, is not enough to cause a chronic *Trichophyton* infection. There must be an individual predisposition for contracting the disease, and this predisposition appears to be a heritable trait.<sup>1,2</sup> The disease is more common with increasing age and in men compared with women.<sup>3–5</sup> Some other diseases have also been associated with chronic dermatophyte infection, e.g.

human immunodeficiency virus infection<sup>6</sup> and atopic respiratory disease.<sup>7,8</sup>

Although dermatophytes are regarded as rare in psoriasis,<sup>9–12</sup> there are some data suggesting that tinea unguium is as common<sup>13,14</sup> or even more common than in controls.<sup>15</sup> Tinea unguium generally occurs secondary to a chronic dermatophyte infection starting as tinea pedis. An increased prevalence of tinea unguium in psoriasis might thus indicate either an increased susceptibility for the infection in dystrophic nails, or an increased prevalence of tinea pedis, thus resulting in a higher rate of nail infection.

The objective of the present study was to measure the prevalence of tinea pedis and pedal tinea unguium in patients with psoriasis compared with a control group.

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## Materials and methods

### Design

The project was conducted as a prospective cross-sectional study. Based on a sample calculation that showed that, assuming a prevalence of tinea pedis of 15% in the control group, an estimated 228 individuals per group were needed to detect a 10% difference in the prevalence with a significance level at 0.050 and a power of 95%.

### Study population

All patients aged 18–64 years with psoriasis on the trunk and/or extremities seen at a department of dermatology in southern Sweden were asked to participate. Patients with disease limited to the hands and/or feet only were not included. Medication with methotrexate, ciclosporin and systemic corticosteroids was not allowed, nor were systemic antifungals during the previous 4 months or topical antifungals during the previous 2 months.

The control group consisted of individuals without signs of psoriasis or atopic dermatitis seeking examination of moles. Exclusion criteria were identical to those in the psoriasis group.

### Clinical examination

Samples for fungal culture and direct microscopy were taken from: (i) the sole, (ii) the interdigital space between the fourth and the fifth toe, and (iii) from any dystrophic toenail, or if the nails were normal, from the nail of the great toe.

### Laboratory examination

Direct microscopy was performed with a solution containing 10% KOH and Parker's Super Quink blue-black ink. Fungal culture was carried out on two different culture media: Sabouraud agar supplemented with gentamicin, and dermatophyte test medium containing cycloheximide and gentamicin. Culture media were supplied by the Department of Clinical Microbiology, Blekinge Hospital (Karlskrona, Sweden). The cultures were inspected weekly and kept for up to 4 weeks before being discarded as negative.

### Statistical analysis

Tinea pedis was defined as a positive dermatophyte culture and/or the occurrence of fungal hyphae in

direct microscopy from the sole and/or the lateral interdigital toe cleft. Tinea unguium was defined as a positive dermatophyte culture and/or positive direct microscopy from the toenails. Statistical analysis was done with the aid of the SPSS computer program version 10.1/11.0 (SPSS, Chicago, IL, U.S.A.). The prevalence of tinea pedis and tinea unguium in the two groups was analysed with the  $\chi^2$  test or Fisher's exact test and the differences between the groups were considered significant when  $P < 0.05$ . As the prevalence of tinea pedis and tinea unguium is dependent on sex and age the results were corrected for these parameters (using a logistic regression model with the presence of tinea as the dependent variable, and age, sex and presence of psoriasis as the independent variable).

## Results

The survey was conducted from May 1998 to December 2000. Of the 496 individuals asked to participate 12 (2.4%) declined, leaving a total of 484 subjects enrolled in the study. The psoriasis group consisted of 239 individuals (90 women and 149 men) with a mean age of 43.8 years (median 49), and the control group of 245 individuals (143 women and 102 men) with a mean age of 38.9 years (median 36).

We found a prevalence of tinea pedis and tinea unguium of 8.8% [95% confidence interval (CI)  $\pm 3.6\%$ ] and 4.6% (95% CI  $\pm 2.7\%$ ), respectively, in patients with psoriasis compared with 7.8% (95% CI  $\pm 3.4\%$ ) and 2.4% (95% CI  $\pm 1.9\%$ ), respectively, in controls. In the whole study group both tinea pedis and tinea unguium were significantly more common in men compared with women: the male/female ratio found was 4 : 1 ( $P < 0.0001$ ) and 3 : 1 ( $P = 0.048$ ), respectively. After regression analysis this difference was confirmed for tinea pedis ( $P < 0.0001$ ), but did not reach statistical significance for tinea unguium ( $P = 0.078$ ).

The prevalence of tinea pedis and pedal tinea unguium is presented in Table 1. There was no statistically significant difference between the psoriasis and control groups, and this finding was maintained after correction for age and sex ( $P = 0.557$  for tinea pedis and  $P = 0.684$  for tinea unguium).

Of the 21 psoriasis patients with tinea pedis six had positive samples from the interdigital space only, two from the sole only, and 13 had positive samples from both the interdigital space and the sole. Of the 19 controls with tinea pedis seven had positive samples

**Table 1.** Prevalence of tinea pedis and pedal tinea unguium

	Psoriasis group		Control group (n = 245)
	(n = 239)	(corrected for age)	
<b>Tinea pedis</b>			
Women	3 (3.3%)	(3.2%)	5 (3.5%)
Men	18 (12.1%)	(10.8%)	14 (13.7%)
Total	21 (8.8%)	(7.5%)	19 (7.8%)
<b>Tinea unguium</b>			
Women	2 (2.2%)	(2.7%)	2 (1.4%)
Men	9 (6.0%)	(3.1%)	4 (3.9%)
Total	11 (4.6%)	(2.8%)	6 (2.4%)

from the interdigital space only, three from the sole only, and nine had positive samples from both the interdigital space and the sole. The predominant organism isolated was *T. rubrum*.

## Discussion

There are few studies of the prevalence of tinea pedis in the general population. In a representative sample of 20 000 persons in the north-eastern U.S.A. in the 1970s (the U.S. Health and Nutrition Examination Survey, HANES) the overall prevalence of tinea pedis was 4%.<sup>16</sup> This survey included children, a group where tinea pedis is a rare event. Two studies on young men prior to military service, one from the U.S.A.<sup>17</sup> and one from Denmark,<sup>18</sup> reported a prevalence of 13.8% and 6.2%, respectively.

The occurrence of tinea unguium in the general population has been more extensively studied. The HANES study mentioned above reports an incidence of 2.2% in the 1970s.<sup>16</sup> Two questionnaire studies, from the U.K.<sup>19</sup> and Spain,<sup>20</sup> report the prevalence of onychomycosis as 2.7% and 2.6%, respectively. A higher figure, 8.4%, was reported in a study from Finland<sup>4</sup> based on samples for microbiological analysis. Although not concerning an unselected population, two recent multicentre studies are of interest. One was conducted at primary care physician offices in the U.S.A. and showed a prevalence of 13.8%.<sup>5</sup> The other survey reported a prevalence of pedal onychomycosis in 9.1% of subjects presenting at dermatologists' offices in Canada.<sup>21</sup> After correction for age and sex the authors estimated the prevalence to be 6.86% in the general population.

In the present study the overall prevalence of tinea pedis and tinea unguium in the control group was 7.8% and 2.4%, respectively, and the corresponding figures for men were 13.7% and 3.9%, respectively. The prevalence of tinea pedis is thus somewhat

higher, and the prevalence of tinea unguium lower than in the general studies cited above. Our study only surveyed the toenails. Although our control group did not seek attendance for inflammatory dermatoses, it still constitutes selected individuals (those showing concern about their health) and thus does not exactly equate to the general population. Other factors contributing to the discrepancies could be a different age distribution and geographical differences. Our study is, however, in line with the increased occurrence of tinea pedis and tinea unguium in men reported previously.<sup>4,16,18</sup>

There are few reports on the occurrence of tinea pedis in psoriasis patients. In one study one case of tinea pedis was found in 107 psoriasis patients with palmoplantar involvement. Mycological studies were only performed in patients with lesions suggestive of tinea infection.<sup>12</sup> This study does not allow any comparison with the general population. A rather high prevalence (13%) of pedal tinea unguium in psoriasis patients was found in a recent large multicentre study.<sup>15</sup> One reason for this discrepancy might be the smaller size of our study. Furthermore, nondermatophyte onychomycosis was also included in the multicentre study,<sup>15</sup> although the contribution of nondermatophyte infection to the total number of cases of onychomycosis found was rather small. We do not know if the age distributions are comparable. In our study immunosuppressive and ongoing antimycotic therapy were exclusion criteria; this was not the case in the multicentre study. The prevalence found in this study was significantly higher than in a control group consisting of other dermatology patients.

As we did not find an increased occurrence of tinea unguium the results of our prospective study are more in accordance with the retrospective study from Germany.<sup>13</sup> In this study the occurrence of tinea pedis and tinea unguium in psoriatic patients did not differ from that in a control group of patients with dermatological diseases other than psoriasis or atopic dermatitis. Likewise, a smaller study from Sweden did not find any differences in occurrence of tinea unguium in psoriatic and nonpsoriatic patients at a department of dermatology.<sup>14</sup>

In conclusion, the present survey showed an equal presence of tinea pedis and tinea unguium in patients with psoriasis and controls when corrected for age and sex. Thus, our findings contradict the hypothesis that there is an altered susceptibility to tinea pedis or tinea unguium in patients with psoriasis.

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