Onychomycosis among psoriasis patients is reported with varying prevalence. This prospective, controlled study investigates the occurrence of onychomycosis among inpatients with psoriasis versus inpatients with other skin diseases. The inclusion period was 15 months. Scrapings from clinically abnormal nails (both fingernails and toenails) were examined using microscopy and culture.

The prevalence of onychomycosis in patients with psoriasis was 17/79 = 21.5% compared to 18/142 = 12.7% for patients with other skin diseases (p = 0.13). In 17 mycologically positive psoriasis patients, dermatophytes, yeasts and moulds were isolated in 8, 10 and 4 cases, respectively, and in 18 mycologically positive patients with other skin diseases in 12, 7 and 5, respectively.

Onychomycosis occurred more frequently in men than in women (psoriasis patients (p = 0.02), patients with other skin diseases (p = 0.03)). Psoriasis patients had a higher frequency of abnormal nails (82.3%) compared to patients with other skin diseases (37.3%) (p < 0.01) and more severe affection of their toenails than patients with other skin diseases (p < 0.01). It is concluded that the frequency of onychomycosis among inpatients with psoriasis compared to inpatients with other skin diseases is not significantly different. Key words: dermatophytes; fungal infection; dermatology.

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MATERIALS AND METHODS

Patients

Patients with psoriasis and patients with other skin diseases were included from the in-patient clinic, at the Department of Dermatology, Bispebjerg University Hospital, Copenhagen, during October 1999 – January 2001. The study was approved by the Regional Scientific-Ethical Committee and informed consent was obtained from all participants. The ages of the included patients were ≥ 18 years and ≤ 70 years. Patients were excluded if systemic or topical antimycotic drugs were given within the last four months or within the last month, respectively. For each patient age, sex, and type of skin disease was registered, and for patients with psoriasis also the duration of disease.

Clinical examination

The following parameters were clinically scored: Area of abnormal nails: 0 = no change, 1 = 0–30%, 2 = 30–60%, 3 = > 60% change of the nail area. Hyperkeratosis, onycholysis, paronychial inflammation, colour change of the nail,
pitting and oil spots were graded separately on a 4-point scale: 0 = no changes, 1 = mild, 2 = moderate and 3 = severe changes of each of the evaluated parameters. A total score was summarized for the parameters, except for pitting and oil spots, which are not specific features in onychomycosis. Three investigators took part in the clinical examinations. Each patient was examined by one doctor.

Statistical methods

Non-parametric statistics was used for data presentation and comparisons between groups. Consequently, medians with 25th and 75th percentiles were used for descriptive statistics and the Mann-Whitney test for 2-group unpaired comparisons. Fisher’s exact test was used for frequency analysis. $P \leq 0.05$ was regarded as statistically significant.

RESULTS

Seventy-nine patients with psoriasis and 142 with other skin diseases were included in the study. Patients with psoriasis had a higher frequency of abnormal fingernails and toenails (82.3%) as compared to other dermatological patients (37.3%) ($p < 0.01$) (Table I). The overall median duration of psoriasis was 22 (10–31) years. For psoriasis patients with onychomycosis the disease duration was 25 (14–30) years and for those without onychomycosis it was 20 (8–30) years ($p = 0.30$).

Table II illustrates the frequencies of onychomycosis

| Table I. Demographic data of patients with psoriasis and other skin diseases |
|-----------------------------|-----------------------------|
|                            | Psoriasis patients          | Patients with other skin diseases $^a$ |
|                            | Overall                     | Women                      | Men                        | Overall                     | Women                      | Men                        |
| Age, median (25th–75th percentiles) | 49 (43–60) | 54 (44–63) | 47 (40–57) | 51 (33–58) | 50 (28–57) | 51 (38–60) |
| Number (n, %)               | 79 (100)                    | 34 (43.0)                  | 45 (57.0)                  | 142 (100)                   | 65 (45.8)                  | 77 (54.2)                  |
| Patients with:             |                            |                            |                            |                            |                            |                            |
| Abnormal nails (n, %)       | 65* (82.3)                  | 26* (32.9)                  | 39* (49.4)                  | 53 (37.3)                   | 20 (14.1)                  | 33 (23.2)                  |
| Abnormal toenails only (n, %) | 62* (78.5)                  | 25* (31.6)                  | 37* (46.8)                  | 49 (34.5)                   | 17 (12.0)                  | 32 (22.5)                  |
| Abnormal finger-nails only (n, %) | 35* (44.3)                 | 11** (13.9)                 | 24* (30.4)                  | 11 (7.7)                    | 6 (4.2)                    | 5 (3.5)                    |

$^a$Mainly erysipelas, atopic dermatitis, eczema, scleroderma and bullous skin diseases. Data are compared for subgroups of patients with psoriasis and other skin diseases. *$p < 0.01$, **$p < 0.002$.

| Table II. Mycological results from patients with psoriasis and other skin diseases |
|-----------------------------|-----------------------------|
|                            | Psoriasis                   | Non-psoriasis               |
|                            | Total no. of patients $n=79$ | Patients with abn. fn $n=35$ | Patients with abn. fn $n=62$ | Total no. of patients $n=142$ | Patients with abn. fn $n=11$ | Patients with abn. fn $n=49$ |
| Dermatophytes total        | 8 (10.1%)                   | 1 (1.3%)                   | 8 (10.1%)                   | 12 (8.5%)                   | 0 (0%)                     | 12 (8.5%)                   |
| Trichophyton rubrum        | 6                          | 0                          | 6                          | 3                          | 0                          | 3                          |
| Trichophyton mentagrophytes | 1                          | 0                          | 1                          | 5                          | 0                          | 5                          |
| Epidermophyton floccosum   | 0                          | 0                          | 0                          | 1                          | 0                          | 1                          |
| Yeasts total               | 10 (12.7%)                  | 5 (6.3%)                   | 7 (8.9%)                   | 7 (4.9%)                   | 2 (1.4%)                   | 5 (3.5%)                   |
| Candida albicans           | 2                          | 0                          | 2                          | 2                          | 1                          | 1                          |
| Candida kruzei             | 7                          | 5                          | 4                          | 5                          | 1                          | 4                          |
| Trichosporon beigeli       | 1                          | 0                          | 1                          | 0                          | 0                          | 0                          |
| Moulds, non-dermatophytes  | 4 (5.1%)                    | 0 (0%)                     | 4 (5.1%)                   | 5 (3.5%)                   | 1 (0.7%)                   | 4 (2.8%)                   |
| TOTAL number of patients   | 17 (21.5%)                  | 6 (7.6%)                   | 19 (24.1%)                 | 18 (12.7%)                 | 3 (2.1%)                   | 21 (14.8%)                 |

Onychomycosis occurred in 17 patients with psoriasis and in 18 non-psoriatics. The occurrence of mixed infections makes the number of positive organisms exceed the number of patients. Furthermore, some patients had onychomycosis in both their fingernails and toenails. Abn. fn = abnormal fingernails. Abn. tn = abnormal toenails.

Data are compared for subgroups of patients with psoriasis and other skin diseases (non-psoriasis).

No significant differences were found.

Acta Derm Venereol 83
in patients with psoriasis (17/79 = 21.5%) and in patients with other skin diseases (18/142 = 12.7%) \( (p = 0.13) \).

**Dermatophytes**

Dermatophytes were demonstrated in 8 of 79 psoriasis patients (10.1%), (mainly *T. rubrum*), compared to 12 of 142 (8.5%) non-psoriatics (mainly *T. mentagrophytes*) \( (p = 0.85) \). Dermatophytes were found more frequently in men than in women in both psoriasis and non-psoriasis patients, i.e. 8 versus 0 \( (p = 0.02) \) and 11 versus 1 \( (p = 0.03) \), respectively. Dermatophytes in fingernails were found in one person only (Table II).

The median age of psoriasis patients with dermatophytosis (51.5, 40.5–64 years) was similar to the median age of psoriasis patients without dermatophytosis (49, 42.5–59 years) \( (p = 0.75) \). For non-psoriatics with dermatophytosis the median age (57.5, 52–65 years) was significantly higher than for those without dermatophytosis (50, 30.5–57 years) \( (p = 0.01) \).

**Yeast**

Yeasts were demonstrated in 10 of 79 psoriasis patients (12.7%), (mainly *Candida (C.) krusei*), and in 7 of 142 non-psoriatics (4.9%), (mainly *C. krusei*) \( (p = 0.08) \). Furthermore, there was no significant difference between women and men having yeast in their nails, neither among the psoriatics \( (p = 0.74) \), nor among the non-psoriatics \( (p = 0.47) \).

**Moulds, non-dermatophytes**

Moulds were demonstrated from only a few patients; 4 psoriasis patients and 5 patients with other skin diseases.

**Severity of nail affection (total score)**

The total scores of clinical toenail affection did not differ from those of clinical fingernail affection within psoriasis patients \( (p = 0.54) \) and within patients with other skin diseases \( (p = 0.11) \) (Fig. 1). However, the psoriasis patients had a significantly higher total score for their toenails (19.0, 9.0–38.0) compared to the non-psoriatics (7.0, 4.0–16.0) \( (p < 0.01) \) (Fig. 1). No differences were seen between the two groups concerning fingernails \( (p = 0.83) \).

In both patient groups, the severity of nail affection in patients with onychomycosis did not differ from that in patients without onychomycosis (Fig. 2).

**DISCUSSION**

The present study is a prospective, controlled study, in which the prevalences of dermatophytes and yeasts were not significantly higher in psoriasis patients than in patients with other skin diseases \( (p = 0.85 \text{ and } p = 0.08, \text{ respectively}) \) (Table II). A higher number of the psoriatics included might have found a significantly higher frequency of yeasts in this patient group.

Several clinical, controlled studies have been published (Table III). As in our study, Staberg et al. (5) and Ständer et al. (6) did not find significant differences between the prevalences of dermatophytes in psoriasis patients compared to non-psoriasis patients (12.3% and 9.8%, respectively). Gupta et al. found a higher prevalence (8.0%) in the psoriasis group (4). However, as can be seen from Table III this prevalence did not differ from Ständer et al. (6). Götz et al. (7) found a lower prevalence in the psoriasis group (14%) compared to the non-psoriasis group (32.7%), but a higher prevalence compared to the psoriasis groups in the studies mentioned above. The very high amount of dermatophytes in the nails of the control group is probably due to a high occurrence of fungal infections in the Ruhr district where the controls came from (7).
Staberg et al. found a tendency towards a higher prevalence of yeasts in the psoriasis group, but it was not significantly different from that of the non-psoriasis patients (5). Ständer et al. found a significantly higher prevalence of yeasts in the psoriasis group with nail changes (23.9%) (6). Gupta et al. found that the occurrence of yeasts in the psoriasis group was almost the same as in the non-psoriasis group (4).

The investigations of Feuerman et al. (10) and Zaias (11) represent uncontrolled studies with very divergent results, i.e. dermatophytes present in 24.2% of abnormal nails versus 0 (Table III).

Nail involvement in psoriasis is common, with reported incidences varying from 10% to 50% (11). In this study, 82.3% had nail abnormalities (Table I). The patients in our study were recruited from the inpatient clinic, and could be assumed to be more severely affected than patients from the outpatient clinic, and this might explain the high occurrence of nail abnormalities. We found that the severity of nail affection could not be used as a marker of onychomycosis (Fig. 2).

In the present study, only clinically abnormal nails were examined for onychomycosis, because onychomycosis is uncommon in normal appearing nails according to Gupta et al., i.e. 0.7% (4).

As in other studies (5–7), the occurrence of yeast was relatively high. The presence of C. krusei in most of the cases is noteworthy. Actually, the number of psoriasis patients with yeast infection was higher than for those infected with dermatophytes. This finding differs from the distribution of pathogens in onychomycosis in the general population of otherwise healthy individuals, in which dermatophytes are the dominating cause of infection in more than 90%. Probably, the altered subungual tissue and onycholysis may facilitate the invasion of yeasts. Furthermore, the fast turnover of the nails in psoriasis patients theoretically may constitute an effective defence against dermatophytes. We considered moulds as secondary invaders, as repeated cultures were not within the scope of this investigation.

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### Table III. Review of studies on onychomycosis in psoriasis patients

| Author, year | Psoriasis patients | Non-psoriasis |
|--------------|-------------------|---------------|
|              | n                  | Dermatophytes (%) | Yeast (%) | n                  | Dermatophytes (%) | Yeast (%) |
| Zaias (11) 1969 | 15                | 0              | Some*      | n.d.              | n.d.              | n.d.      |
| Götz (7) 1974   | 100               | 14.0            | 16.0       | 1000              | 32.7              | n.d.      |
| Feuerman (10) 1976 | 120            | 24.2            | 15.0       | n.d.              | n.d.              | n.d.      |
| Staberg (5) 1983 | 78              | 12.3            | 15.4       | 41                | 9.8               | 9.8       |
| Gupta (4) 1997  | 561              | 8.0             | 0.5        | 922               | 4.4               | 0.3       |
| Ständer (6) 2001 | 250             | 9.8             | 23.9       | 102               | 10.8              | 6.9       |
| Present study 2002 | 79             | 10.1            | 12.7       | 142               | 8.5               | 4.9       |

Some of the studies included both fingernails and toenails (5, 6, 10, present study), while others only included toenails (4, 7). n.d. = not done.

*From subungual debris in 40 psoriatic nails of 15 patients, 22 yeasts were isolated.

*Acta Derm Venereol 83*