mission to include data from our preliminary study (4) or PIIINP in MTX-induced liver fibrosis and cirrhosis in this publication and also for their good and kind advice.

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Trichophyton Rubrum Abscesses in Immunocompromized Patients

A Case Report

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A 72-year-old immunocompromised man with myelodysplastic syndrome who developed multiple erythematous, scaly abscesses like lesions on his left foot and lower leg is described. He also had dry scaly lesions on his soles and lesions on several toe nails. A punch biopsy showed abscesses with fungal elements and *Trichophyton rubrum* was cultured from skin scales and the biopsy. A diagnosis of *T. rubrum* abscesses should be suspected in all immunocompromised patients with signs of superficial dermatophyte infection.

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Infections with *Trichophyton rubrum* are usually localized to the stratum corneum, hairs and nails. Deep infection with *T. rubrum* has been described in immunocompromised patients. Meinhoff describes multiple *T. rubrum* abscesses as a type of dermatophytosis distinguishable clinically and histopathologically from Kerion celsi and Majocchi's granuloma (1). Subsequently other cases have been described in the literature (2, 3).

CASE REPORT

A 72-year-old man, in whom pancytopenia was diagnosed in December 1984, is presented. The bone marrow was hypocellular in repeated biopsies, and he was initially considered as a case of aplastic anaemia. Blood transfusions had to be given at 4–8 week intervals; otherwise he remained general good health for nearly 3 years. In May 1985, non-A, non-B hepatitis was diagnosed.

When the patient was followed with repeated bone marrow examinations, his cellularity eventually increased and he became hypercellular. He developed morphologic abnormali-

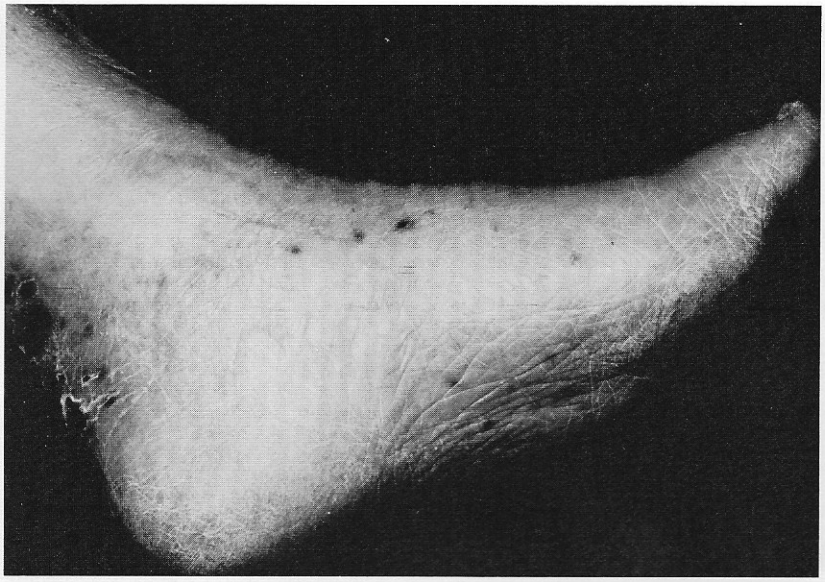

Fig. 1. Multiple dark erythematous scaling lesions on the lower leg and left foot of a patient with myelodysplastic syndrome.

ties in all haematologic cell lines, characteristic of a myelodysplastic syndrome. Late in 1987 he also showed laboratory and clinical signs of secondary hemosiderosis.

In December 1987 his condition deteriorated and the need for transfusions increased. Hemolysis became more marked, but was reduced after the institution of a high dose of prednisolone (100 mg daily) since Dec. 20. No manifest leukaemia was present and no cytostatic therapy was given. On January 19, 1988 he developed skin lesions on his left foot and lower leg. When the patient was first seen by a dermatologist the preliminary diagnosis was vasculitis and a punch biopsy was taken from non-ulcerated lesion.

After the histopathological diagnosis of a fungal infection itraconazole 100 mg capsules was given as three capsules once daily. The medication was started on January 22. On January 23, high septic fever occurred and the patient was treated with a combination of ceftazidime and vancomycin i.v. Blood cultures were positive for *Staphylococcus aureus* and he responded rapidly to the given antibiotics. One of the authors was informed of the histopathological diagnosis on day 5 and the patient was examined again.

During the following 2 weeks the patient's condition further deteriorated, with signs of liver insufficiency and mental confusion. Due to the liver insufficiency, itraconazole thera-

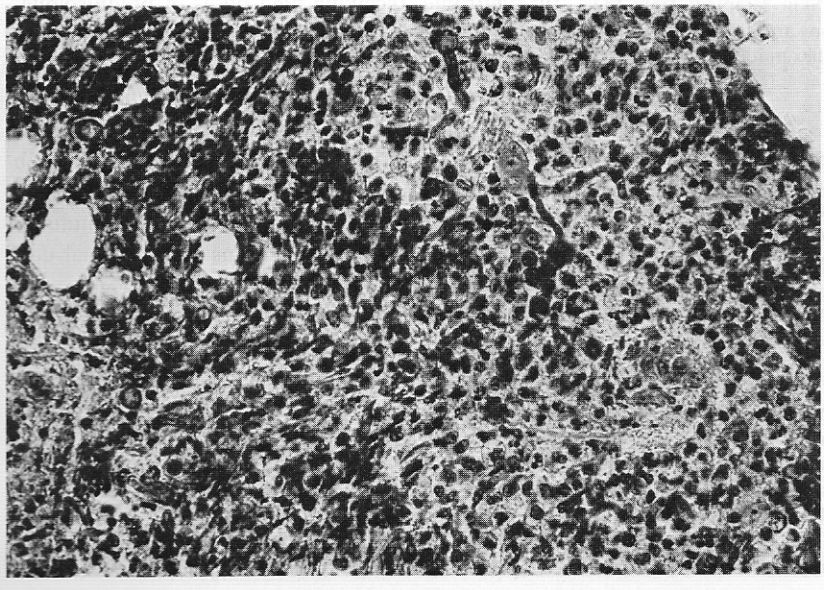

Fig. 2. Septate hyphae and swollen arthrospores in the dermis.

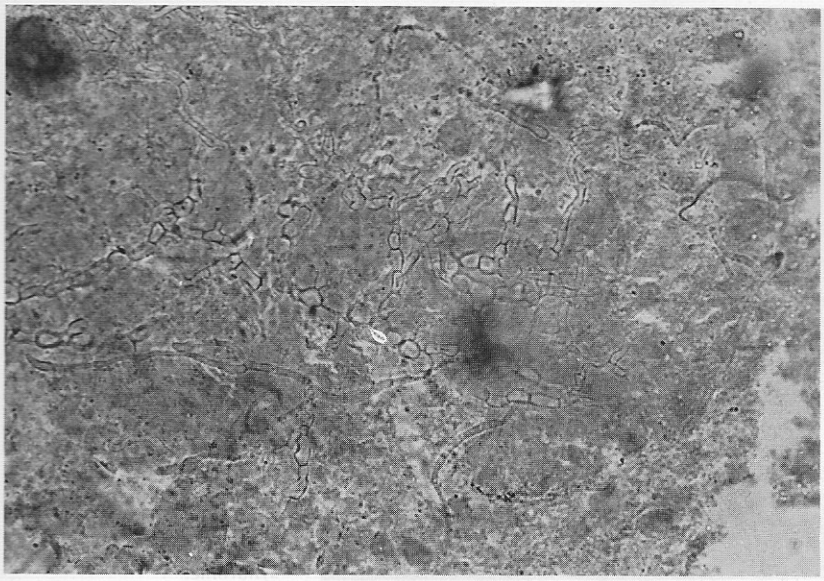

Fig. 3. Microscopic appearance of *T. rubrum* from the part of the culture close to the skin biopsy showing septate hyphae and chlamydospores.

py was stopped on February 3. The patient died on February 8.

Clinical signs

At the first clinical examination, multiple dark erythematous, scaling lesions were present on the patient's left foot and lower leg (Fig. 1). Some of the lesions had ulcerated. He also had dry scaly lesions on both soles and changes in several toe nails. These lesions had been present for several years.

At the second clinical examination the lesion had now started to heal but scaly erythematous lesions were still present on the left foot and lower leg, together with scaly lesions on both soles and lesions on several of the toe nails. A new punch biopsy was taken and transferred to Sabouraud's agar medium without cyclohexamide. Skin scrapings from the soles were taken for direct microscopy and also transferred to Sabouraud's medium without cyclohexamide, DTM agar and casein agar and incubated at 32°C.

Histopathology

In the deeper part of the corium at the junction of dermis and subcutaneous fat around degenerated, thick-walled blood vessels, there were granulomatous infiltrates composed of histiocytes, lymphocytes and numerous neutrophils. In the infiltrates there were septated hyphae and arthrospores. Some of the septate hyphae were swollen and the arthrospores varied in size (Fig. 2). No fungi were seen in the stratum corneum.

Mycology

Direct microscopy from the soles showed septate hyphae and arthrospores. *T. rubrum* was cultured from both the biopsy and skin scales from the foot after one week. When the fungus was growing close to the biopsy, swollen septate hyphae and clamydospores were seen (Fig. 3). In the perifery of the culture and in cultures from skin scales, multiple pear-shaped microconidia and thin, pencil-like macroconidia were seen.

DISCUSSION

The natural habitat for dermatophytes is usually the stratum corneum. In immunocompromised patients, deep abscesses like lesions with both *T. rubrum, T. varicosum, T. schönleinii* and *T. violaceum* have been described (1). The change in immune function may affect the reaction of the dermatophytes in immunocompromized patients. Dermatophytes can be potentially invasive fungi. Even death caused by *T. rubrum* has been described (1).

We describe a 72-year-old man with myelodysplastic syndrome, receiving high doses of prednisolone, who developed vasculitis-like *T. rubrum* infections on one lower leg. Fungal elements were seen histopathologically and the diagnosis of *T. rubrum* infection confirmed by direct microscopy and culture. The diagnosis of *T. rubrum* abscesses may be more common than earlier thought and the diagnosis of deep *T. rubrum* infection should be suspected in all immunocompromised patients with signs of superficial dermatophyte infections.

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Experimental Dermatophyte Infection. The Extent of the Fungal Invasion

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A spore suspension from a granular strain of *Trichophyton mentagrophytes* under occlusion for 4 days was used to produce two fungal lesions on the upper arm of the Trichophytin-negative author. The material for culture was obtained by stripping across the visible lesions and several centimetres into the surrounding skin. Already when the occlusion was removed, the whole stratum corneum was heavily invaded up to 20 mm into the surrounding, normal-looking skin. When the intensity and the size of the visible lesions topped after about 2 weeks, the culture positivity reached 45 mm into the perilesional skin. One week later the spontaneous involution had eliminated nearly all fungal organisms through the entire horny layer of both the visible lesions and their surroundings. After 42 days the lesions were culture-negative. It was concluded that the growth pattern of an experimental infection could be as observed in natural infections. *Key words: Superficial fungal infections; Delayed hypersensitivity; Experimental dermatology.*

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According to the literature (1–4), artificially produced dermatophytosis is comparable to the natural infection in all essential respects. In a natural dermatophyte infection the mycelia invade the stratum corneum (5, 6) and its horizontal extent reaches several centimetres outside the peripheral demarcation of the visible changes (6).

In the present study, stratum corneum strippings were cultured to investigate whether a similar invasion, including the perilesional extension, could be observed during a primary experimental infection.

MATERIAL AND METHODS

The experimentally infected person (the author) had no previous dermatophytic infection and was Trichophytin-negative.

Preparation of inoculum

1/4 ml of material from a 3-week-old culture of a granular strain of *Trichophyton mentagrophytes* (isolated from lesions in a man infected by a guinea pig) was suspended in 2 ml of sterile 0.9% NaCl, homogenized by shaking with glass beads, filtered through Whatman 43 paper to remove mycelia and resuspended in 0.9% saline with chloramphenicol 100 mg/100 ml, adjusted to contain 600 spores/ml by haemocytometer count.

Inoculation of test sites

Two circular fields, 1 and 2, diameter 30 mm, were delineated on the inside of the right upper arm, 5 cm apart. Without any prior preparation of the skin, two drops (0.07 ml) of the spore suspension, containing about 40 spores, were applied to each field, which then were covered with 30 mm pieces of sterile gauze moistened with three drops of sterile water and occluded with Steridrape and Durapore (from 3M, Minnesota Mining & Manufacturing Co., Los Angeles, Calif., USA) for 4 days.

The size of the visible infection during the period of observation was based on the shortest and longest diameter for each field and determined as the average diameter of the two lesions. The severity of the visible infection was graded at the same time as follows: + (erythema), ++ (erythema and edema), +++ (erythema, edema and vesiculation).

Trichophytin test: 0.1 ml of a commercial product (Dermatophytin 1 : 30, Hollister-Stier, USA) on the upper arm, read after 72 h.

Culture study

The material was obtained by stripping with a 1 cm wide vinyl tape (Scotch tape 681, 3M) perpendicular to the arm across the middle of the visible lesions, outlined with a ballpoint pen, and some centimetres into the surrounding normal-looking skin.

On days 0 and 13 (Fig. 1) the strippings were taken from field 1, on days 7 and 20 from field 2. Stripping was repeated in the same track until the surface appeared glossy after 12–14 strippings. The three most superficial, three from the middle and the last three of the strippings were kept for culturing.

On days 25, 35 and 42, culture material was obtained from both fields. Only the three most superficial strippings were taken and used from each of the fields. The pieces of tape were placed, adhesive side down, on the surface of Sabouraud glucose agar containing chloramphenicol (40 mg/l) and cycloheximide (500 mg/l). The plates were incubated at 26°C and