A Case of Tinea Pedis in a Child Caused by *Trichophyton interdigitale* with Two Different Colony Phenotypes on Primary Culture

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ABSTRACT

An otherwise healthy 3-year-old girl presented with scaly lesions on her palms and soles that had been present for several months. Both palms and the right sole had been successfully treated with a steroid ointment (betamethasone butyrate propionate) and zinc oxide ointment for a diagnosis of pompholyx at a nearby dermatology clinic, but the lesion on the left sole persisted and spread to the back of the foot. On the initial visit, the patient exhibited an itchy and scaly erythematous left foot lesion. Direct microscopic examination of the scales revealed a considerable amount of fungal elements. A diagnosis of tinea pedis was made, and antifungal treatment with a neticonazole ointment was initiated. Complete cure was achieved after 4 weeks of treatment. The primary mycological cultures from the scales simultaneously revealed two types of colonies: a white powdery flat colony and a white downy elevated colony with a reddish-yellow bottom. Although the powdery colony was identified as *Trichophyton mentagrophytes* complex on slide culture, the downy colonies could not be identified based on cultural and morphological characteristics. The nucleotide sequences of the internal transcribed spacer region from both colonies showed an exact match, which eventually led to their identification as *Trichophyton interdigitale*. Further genotyping at three points in the non-transcribed spacer region in both colonies also showed the same NTS type of D2II. It is very rare for two morphologically different colonies to be isolated from the primary culture under the same conditions in tinea cases. Genetic tests are of extreme value to identify the strain in such cases.

**Key words**: tinea pedis, *Trichophyton interdigitale*, cultural findings, genetic testing

Introduction

Although the culture results for *Trichophyton interdigitale* vary, it is very rare to isolate two morphologically different colonies from the primary culture. We present a case of tinea pedis in a child caused by *T. interdigitale*, in which both powdery and downy colonies were simultaneously isolated from the primary culture. We also report statistical data of tinea pedis in children.

Case

An otherwise healthy 3-year-old girl presented with scaly lesions on her palms and soles that had been present for several months. Both palms and the right sole had been successfully treated with a steroid ointment (betamethasone butyrate propionate) and zinc oxide ointment for a diagnosis of pompholyx at a nearby dermatology clinic, but the lesion on the left sole persisted and spread to the back of the foot. It was at this point that the patient was referred to us. Although her family did not have a history of tinea pedis, her grandfather, who is not living them, had it.
There were no pets in her house. At the initial visit, physical examination revealed well-circumscribed, scaly, erythematous, itchy lesions with marginal red papules on the back of the left foot. There was prominent dry scaling between the digits and on the toes and soles (Fig. 1a, b). A diagnosis of tinea pedis was made, and antifungal treatment with a neticonazole ointment was initiated. Complete cure was achieved after 4 weeks of treatment.

Mycological findings

A direct microscopic examination of the scale on the left foot revealed a considerable amount of fungal elements. The two primary plate cultures (Sabouraud Dextrose Agar at 25°C) from the scales simultaneously revealed two types of colonies: predominantly white downy elevated colonies with reddish-yellow bottom color and, additionally, white powdery flat colonies (Fig. 2a, b). The cultural characteristics of the two types of colonies did not change even after four successive cultures (Fig. 2c, d). Although the powdery colony was identified as *T. mentagrophytes* complex on slide culture (Fig. 3a), only non-specific hyphae were obtained from the downy colonies (Fig. 3b). The nucleotide sequences of the internal transcribed spacer (ITS) region from both colonies exhibited an exact match and were eventually identified as *T. interdigitale*. Further genotyping with PCR at three places in the non-transcribed spacer (NTS) region in both colonies also showed the same type of D2II (Fig. 4).

Discussion

Tinea pedis in children is commonly either an interdigital or pompholyx type but is rarely a hyperkeratotic type\(^1\). The reason for this tendency is thought to be the narrow interdigital spaces and excessive sweating in children\(^1\). The paucity of the hyperkeratotic type could be due to the thin horny layer, the short disease duration, and the lack of coexisting illnesses such as diabetes\(^1\). Epidemiological studies by the Japanese Society for Medical Mycology\(^2\) revealed that the age-specific consultation rate was less than 1% in 0- to 9-year-olds and less than 4% even in 0- to 19-year-olds. The response to treatment is generally good, and the recurrence rate is low\(^2\). The clinical...
manifestation is usually mild with only dry scaling but with no blister formation. Such lesions might heal spontaneously without visiting a clinic. Although the present case was interdigital and pompholyx type, it became exacerbated and extended to the back of the foot because of inappropriate treatment with a steroid ointment. Obtaining a complete family history is essential because of the high rate of family infections. As the present case had no family history, infection from the grandfather living separately from them or outdoor activities such as swimming could be considered as possible routes of infection. The causative fungi for tinea pedis are T. rubrum and T. mentagrophytes (presently, T. interdigitale), and Hiruma et al. reported that the ratio of T. rubrum to T. mentagrophytes was 1.96 in adults and 1.07 in children. Accordingly, they suggested that T. mentagrophytes infection is more common in children.

T. mentagrophytes is a complex of several species. Its classification has been changed due to confusion in the naming system. The species complex includes two distinct forms: zoophilic and anthropophilic. Although typical colonies of anthropophilic isolates are flat with a cream-to-buff or tan, powdery appearance, variations occur in colony color and surface texture. The anthropophilic isolates were designated as T. interdigitale. We first considered superinfection with T. interdigitale and T. rubrum in the present case. We regret that a culture in Potato Dextrose Agar was not performed. Genetic analysis, however, revealed that the two colonies were genetically identical as T. interdigitale based on the nucleotide sequences of the ITS region.

The most interesting finding in this case was that two morphologically different colonies were isolated from the primary culture. This phenomenon has not been described in any textbook or literature before. We requested Professor Takashi Mochizuki of Kanazawa Medical University to conduct further genotypic examination of minor genetic variations to determine whether the two colonies were the same species or not.

Further subtyping based on length polymorphisms at each of the three variable loci (TmiS0, TmiS1, and TmiS2) of the NTS region of the two strains of T. interdigitale showed that the two colonies were both of the D2II type. D2II is the most frequent genotype of T. interdigitale in Japan. Moreover, a single lesion is usually caused by a single fungus and not by
superinfection with two strains. We eventually determined the two colonies were the same strain of *T. interdigitale*.

**Conclusion**

Although tinea pedis in children is statistically infrequent, it should be noted that the clinical presentation may be overlooked as a mild condition. It is very rare for two morphologically different colonies to be isolated from the primary culture under the same conditions in tinea cases. Genetic analysis is of extreme value when the culture shows confusing findings.

**Self-declared COI content**

None.

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**References**