Original Article

Tinea Faciei Caused by *Trichophyton mentagrophytes* (Molecular Type *Arthroderma benhamiae*) Mimics Impetigo: A Case Report and Literature Review of Cases in Japan

Utako Kimura¹, Kae Yokoyama¹, Masataro Hiruma², Rui Kano³, Kenji Takamori¹, Yasushi Suga¹

¹Department of Dermatology, Juntendo University Urayasu Hospital
²Ochanomizu Institute for Medical Mycology and Allergology
³Department of Pathobiology, Nihon University School of Veterinary Medicine

ABSTRACT

A 36-year-old female elementary school teacher presented with aggregated serous papules surrounded by mild erythema, extending from both nasal wings/nostrils down to the upper lip. No improvement was seen following treatment of the lesions with topical antibiotics for impetigo. Potassium hydroxide (KOH) direct microscopy confirmed the presence of mycelia, and the infection was diagnosed as tinea faciei. The isolate was identified as *Trichophyton mentagrophytes* using morphological analysis and as *Arthroderma benhamiae* using genetic analysis. Here we describe that case and summarize the clinical features of other cases of *A. benhamiae* infection in Japan that have been reported in the literature.

Key words: *Trichophyton mentagrophytes*, *Arthroderma benhamiae*, tinea faciei, tinea corporis

Introduction

*Arthroderma benhamiae*, a teleomorph of *Trichophyton mentagrophytes*, is a dermatophyte that has been isolated from rabbits, guinea pigs and similar rodents. Kano et al.⁴ first isolated *A. benhamiae* from rabbits in 1998; two years later, in 2000, Kawasaki et al.⁵ reported the first Japanese case of tinea corporis caused by *A. benhamiae*. Since then, several cases of *A. benhamiae* infections have been reported sporadically in Japan⁶⁻⁷. We diagnosed a case of tinea faciei with a peculiar clinical feature caused by *T. mentagrophytes*, which was identified as *A. benhamiae* using genetic analysis. Here we describe the case and summarize the clinical features of other cases of *A. benhamiae* infection in Japan that have been reported in the literature.

Case report

A 36-year-old woman who worked as an elementary school teacher visited a local clinic for treatment of eruptions around both nostrils of approximately 1 month’s duration. She was treated topically with a gentamicin-containing ointment for 2 weeks; however, the eruptions continued to spread. She was referred to our department in April 2013.

The patient presented at our clinic with a lesion of aggregated serous papules surrounded by mild erythema extending from both nasal wings/nostrils down to the upper lip. The lesion was covered with scales and crusts (Fig. 1). She did not report any subjective symptoms such as pruritus, and both her medical history and her family history were unremarkable.
The initial diagnosis was impetigo, and treatment consisted of oral administration of faropenem and topical application of chloramphenicol-containing ointment. At a follow-up visit one week later, the eruptions had not been relieved. Bacterial culture gave negative results, so mycosis was suspected. Potassium hydroxide (KOH) direct microscopy confirmed the presence of mycelia. Mycological tests were then performed.

White colonies with a velutinous center and powdery margins were formed during a 14-day giant culture on Mycosel agar at 27°C (Fig. 2a). Grape-like clusters of sesame seed-like microconidia and club-shaped macroconidia were observed on slide culture (Fig. 2b). The isolate was identified as *T. mentagrophytes* based on morphological characteristics. Sequence analysis of the internal transcribed spacer (ITS) regions of ribosomal RNA genes was performed as described previously[^5^], and the clinical isolates were shown to match the registered strains of *A. benhamiae* (GenBank Accession nos. AB686481–AB686487).

The eruptions were relieved after 4 weeks of topical application with clotrimazole and oral administration of terbinafine (125 mg/day). Neither the patient nor family members living with her had tinea.

The family had no companion animals, but as an elementary schoolteacher, the patient often took her pupils to a nearby zoo, where rabbits and guinea pigs could be petted freely. The zoo had 5 rabbits and 20 guinea pigs, which were all tested as possible sources of infection. Although

*Arthroderma vanbreuseghemii* was isolated from 19 guinea pigs, *A. benhamiae* was not isolated from any of the animals. We were thus unable to identify the source of the infection.

**Discussion**

*Arthroderma benhamiae*, which is a teleomorph of *T. mentagrophytes* complex, is a zoophilic tineacausing dermatophyte isolated from rodents, such as rabbits and guinea pigs[^6^]. In Japan, this fungus had never been isolated before 1980[^7^], and the first case of tinea corporis due to the fungus, transmitted from rabbits, was reported in 2000[^2^]. Since then, *A. benhamiae* infection has been reported sporadically worldwide[^3^, 4, 8–11^].

Mochizuki[^12^] identified and reviewed 15 reported cases of *A. benhamiae* infection in Japan. Subsequently, 8 additional cases[^5^, 10, 11, 12–15^], including our

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[^14]: Reference text
[^15]: Reference text
### Table 1. Summary of *A. benhamiae* cases reported in Japan

<table>
<thead>
<tr>
<th>Case No.</th>
<th>Reference</th>
<th>Age (yrs)</th>
<th>Sex</th>
<th>Prefecture</th>
<th>Disease Type</th>
<th>Affected Sites</th>
<th>Clinical feature</th>
<th>Molecular Biological Analysis</th>
<th>Mating Test</th>
<th>Patient's Association with Animals</th>
<th>Detection of Strain in Animals</th>
<th>Clinical feature of animal</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Kawasazi</td>
<td>7</td>
<td>F</td>
<td>Simane</td>
<td>Tineacorporis</td>
<td>Neck, forearm</td>
<td>Erythema with raised border and scale</td>
<td>No data</td>
<td>Succeeded</td>
<td>Owned rabbit</td>
<td>+ (rabbit)</td>
<td>Alopecia</td>
<td>Child of Case 2</td>
</tr>
<tr>
<td>2</td>
<td>Kawasazi</td>
<td>30</td>
<td>F</td>
<td>Simane</td>
<td>Tineacorporis</td>
<td>Shoulder, lower leg</td>
<td>A plaque of multiple red papules</td>
<td>No data</td>
<td>Succeeded</td>
<td>Owned rabbit</td>
<td>+ (rabbit)</td>
<td>Alopecia</td>
<td>Mother of Case 1</td>
</tr>
<tr>
<td>3</td>
<td>Tozaki</td>
<td>26</td>
<td>F</td>
<td>Gifu</td>
<td>Tineacorporis</td>
<td>Hand, face</td>
<td>Erythema with raised border and scales</td>
<td>Done</td>
<td>Succeeded</td>
<td>Worked at pet shop</td>
<td>Not done</td>
<td>No data</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Hattori</td>
<td>4</td>
<td>M</td>
<td>Tokyo</td>
<td>Tineacapitis (Kerion)</td>
<td>Head</td>
<td>Tender, crusted, and purulent lesions</td>
<td>Done</td>
<td>Succeeded</td>
<td>Owned guinea pig</td>
<td>− (guinea pig)</td>
<td>Hair loss</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Nakamura</td>
<td>29</td>
<td>M</td>
<td>Tokyo</td>
<td>Tineacorporis</td>
<td>Forearm, thigh</td>
<td>Erythematous lesions with small vesicles</td>
<td>Done</td>
<td>Succeeded</td>
<td>Owned rabbit</td>
<td>+ (rabbit)</td>
<td>Erythema with alopecia</td>
<td>Spouse of Case 5</td>
</tr>
<tr>
<td>6</td>
<td>Nakamura</td>
<td>31</td>
<td>F</td>
<td>Tokyo</td>
<td>Tineacorporis</td>
<td>Face, hip</td>
<td>Erythematous lesions with small vesicles</td>
<td>Done</td>
<td>Succeeded</td>
<td>Owned rabbit</td>
<td>+ (rabbit)</td>
<td>Erythema with alopecia</td>
<td>Spouse of Case 6</td>
</tr>
<tr>
<td>7</td>
<td>Imafuku</td>
<td>22</td>
<td>M</td>
<td>Nagasaki</td>
<td>Tineacorporis</td>
<td>Face, scrotum</td>
<td>Erythematous lesions with scales</td>
<td>Done</td>
<td>Failed</td>
<td>Owned rabbit</td>
<td>+ (rabbit)</td>
<td>Erythema with alopecia</td>
<td>Child of Case 8</td>
</tr>
<tr>
<td>8</td>
<td>Imafuku</td>
<td>46</td>
<td>F</td>
<td>Nagasaki</td>
<td>Tineacorporis</td>
<td>Face</td>
<td>Erythema with raised border and scales</td>
<td>Done</td>
<td>Failed</td>
<td>Owned rabbit</td>
<td>+ (rabbit)</td>
<td>Erythema with alopecia</td>
<td>Mother of Case 7</td>
</tr>
<tr>
<td>9</td>
<td>Mochizuki</td>
<td>53</td>
<td>F</td>
<td>Ishikawa</td>
<td>Tineacorporis</td>
<td>Face</td>
<td>Erythema was clearly demarcated with a slightly depressed center</td>
<td>Done</td>
<td>Succeeded</td>
<td>None</td>
<td>None</td>
<td></td>
<td></td>
</tr>
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<td>10</td>
<td>Higashi</td>
<td>44</td>
<td>F</td>
<td>Osaka</td>
<td>Tineacorporis</td>
<td>Not specified</td>
<td>No data</td>
<td>Done</td>
<td>No data</td>
<td>Owned guinea pig</td>
<td>No data</td>
<td>No data</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Tanaka</td>
<td>4</td>
<td>M</td>
<td>Shiga</td>
<td>Tineacapitis (Kerion)</td>
<td>Head</td>
<td>Adhered crusts with hair loss</td>
<td>Done</td>
<td>No data</td>
<td>None</td>
<td>None</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Yamaguchi</td>
<td>24</td>
<td>F</td>
<td>Kanagawa</td>
<td>Tineacorporis</td>
<td>Face</td>
<td>Erythematous lesions with pustules</td>
<td>Done</td>
<td>Failed</td>
<td>Owned rabbit</td>
<td>− (rabbit)</td>
<td>Alopecia</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Kakutani</td>
<td>11</td>
<td>M</td>
<td>Yamagata</td>
<td>Tineacorporis</td>
<td>Jaw, back</td>
<td>Erythematous lesions with scales</td>
<td>Done</td>
<td>Failed</td>
<td>Owned rabbit</td>
<td>+ (rabbit)</td>
<td>Alopecia</td>
<td>Child of Case 14</td>
</tr>
<tr>
<td>14</td>
<td>Kakutani</td>
<td>41</td>
<td>F</td>
<td>Yamagata</td>
<td>Tineacorporis</td>
<td>Forearm</td>
<td>Erythematous lesions with scales</td>
<td>Done</td>
<td>Succeeded</td>
<td>Owned rabbit</td>
<td>+ (rabbit)</td>
<td>Alopecia</td>
<td>Mother of Case 13</td>
</tr>
<tr>
<td>15</td>
<td>Mochizuki</td>
<td>26</td>
<td>F</td>
<td>Ishikawa</td>
<td>Tinea mannium</td>
<td>Hand</td>
<td>Erythematous lesions with small vesicles</td>
<td>Done</td>
<td>Succeeded</td>
<td>Owned hedgehog</td>
<td>+ (hedgehog)</td>
<td>No symptoms</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Shiraki</td>
<td>25</td>
<td>F</td>
<td>Tokyo</td>
<td>Tineacorporis</td>
<td>Wrist</td>
<td>Scaly erythematous lesion with large bullae on the borders</td>
<td>Done</td>
<td>Succeeded</td>
<td>Worked at pet shop</td>
<td>Not done</td>
<td>No data</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Shiraki</td>
<td>6</td>
<td>F</td>
<td>Tokyo</td>
<td>Tineacapitis (Kerion)</td>
<td>Head</td>
<td>Boggy and indurated areas exuding pus with hair loss</td>
<td>Done</td>
<td>No data</td>
<td>None</td>
<td>None</td>
<td></td>
<td></td>
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<tr>
<td>18</td>
<td>Fujita</td>
<td>45</td>
<td>F</td>
<td>Niigata</td>
<td>Tineacorporis</td>
<td>Shoulder</td>
<td>Erythema was clearly demarcated with scales</td>
<td>Done</td>
<td>Succeeded</td>
<td>Owned rabbit</td>
<td>Not done</td>
<td>No symptoms</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Kitami</td>
<td>47</td>
<td>F</td>
<td>Tokyo</td>
<td>Tineacorporis</td>
<td>Face</td>
<td>Erythema with central healing tendency</td>
<td>Done</td>
<td>No data</td>
<td>Owned guinea pig</td>
<td>+ (guinea pig)</td>
<td>No symptoms</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Sujino</td>
<td>10</td>
<td>F</td>
<td>Tokyo</td>
<td>Tineacorporis &amp; Tineacapitis</td>
<td>Hand, face, head</td>
<td>Erythema was clearly demarcated with scales</td>
<td>Done</td>
<td>No data</td>
<td>Petted rabbits and guinea pigs at zoo</td>
<td>Not done</td>
<td>No data</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Kobayashi</td>
<td>27</td>
<td>F</td>
<td>Ishikawa</td>
<td>Tineacorporis</td>
<td>Forearm</td>
<td>Erythema with central healing tendency</td>
<td>Done</td>
<td>Succeeded</td>
<td>Owned guinea pig</td>
<td>+ (guinea pig)</td>
<td>Alopecia</td>
<td>Sister of Case 22</td>
</tr>
<tr>
<td>22</td>
<td>Kobayashi</td>
<td>25</td>
<td>F</td>
<td>Ishikawa</td>
<td>Tineacorporis</td>
<td>Jaw, lower leg</td>
<td>Erythematous lesions with scales</td>
<td>Done</td>
<td>Succeeded</td>
<td>Owned guinea pig</td>
<td>+ (guinea pig)</td>
<td>Alopecia</td>
<td>Sister of Case 21</td>
</tr>
<tr>
<td>23</td>
<td>Our patient</td>
<td>36</td>
<td>F</td>
<td>Chiba</td>
<td>Tineacorporis</td>
<td>Face</td>
<td>Serious papules surrounded by erythema where the lesion was covered with scales and crusts</td>
<td>Done</td>
<td>Not done</td>
<td>Petted rabbits and guinea pigs at zoo</td>
<td>− (rabbit, guinea pig)</td>
<td>No symptoms</td>
<td></td>
</tr>
</tbody>
</table>
case, have been reported, bringing the total to 23 cases (Table 1).

The 23 cases include 18 women (78%) and 5 men (22%), with a mean age of 26.9 years, suggesting a higher incidence of *A. benhamiae* infection in women and a higher prevalence in young people. There were 20 cases of tinea corporis and 4 cases of tinea capitis, including 3 cases of kerion celsi. One patient had both tinea corporis and tinea capitis. In 19 cases eruption sites were seen in exposed regions (i.e., face, neck, hands, head, and lower arms), with 10 cases of eruptions occurring on the face. Many lesions were eczematous, and a few cases showed a tendency towards healing in the center of the affected area. Facial eruptions were erythematous/ exfoliative lesions. Our case exhibited impetigo-like symptoms, which made differential diagnosis difficult.

In the 23 cases reviewed here, molecular biological analysis identified the fungus in 21 cases and mating tests identified the fungus in 13 cases, with both tests performed successfully in 11 cases. Contact with animals was identified as the source of infection in 20 cases of breeders of rabbits and guinea pigs and pet shop workers. In 12 (52.2%) of the cases, the same causative fungus was isolated from the animals. However, in our case, we did not isolate the causative agent *A. benhamiae* from the small animals in the zoo.

Detailed mycological studies on *A. benhamiae* infection are rarely conducted, and the current status of the infection remains unknown. Our literature review suggests that *A. benhamiae* may have already colonized Japan. However, in routine dermatological practice in Japan, few clinics prepare fungal cultures, and even fewer clinics perform molecular biological analysis. Thus, the current status of *A. benhamiae* infection is almost unknown.

In recent years, the practice of keeping companion pets in the home has become more widespread in Japan. Moreover, there has been an increase in the number of facilities where individuals have direct contact with small animals, such as petting zoo parks and coffee shops, where customers can pet rabbits. Further increase in the incidence of dermatomycosis caused by zoonotic fungi is a concern. In routine clinical practice, dermatologists need to aggressively perform microscopic examinations and fungal cultures of samples from eruption lesions, and interview patients in detail regarding any companion animals.

References

