CASE REPORT

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Microbiological Identification of *Dermatophilus congolensis* in a Rare South Korean Case of Human Dermatophilosis

Jang-Hoon Yi, Kyung-Deok Park, Hyeong-Won Hong, Ki-Ho Kim and Jung-Ho Yoon†

Department of Dermatology, College of Medicine, Dong-A University, Busan, Korea

Human infection with *Dermatophilus congolensis* is an extremely rare zoonosis. This study aimed to report a case of a 30-year-old healthy urban man with refractory, linear, and crusted lesions on the face and left arm following a minor trauma. The diagnosis was confirmed via microbiological culture and matrix-assisted laser desorption/ionization time-of-flight mass spectrometry (MALDI-TOF MS). Notably, the organism showed optimal growth only at a temperature of 37℃, whereas growth at a temperature of 30℃ was insignificant, suggesting a potential diagnostic pitfall. The patient was successfully treated with oral doxycycline. The findings of this study suggest the importance of considering *D. congolensis* in dermatitis unresponsive to empirical therapy and emphasize the diagnostic value of incubation at a temperature of 37℃ and MALDI-TOF MS.

Key Words: Dermatophilosis, *Dermatophilus congolensis*, MALDI-TOF MS, Microbiological culture, Zoonoses

INTRODUCTION

Dermatophilus congolensis is a facultative anaerobic, Gram-positive actinomycete primarily responsible for exudative dermatitis, which is also referred to as dermatophilosis, in livestock[1,2]. Despite its prevalence, human infection with this veterinary pathogen is still considered a rare zoonosis[3-5,9]. The first human cases in the United States were reported in 1961 involving individuals exposed to an infected deer[3,6,9,10]. The clinical manifestations typically include pustules, exudative erythematous plaques, and crusts, which can often mimic different types of pyoderma or viral infection[3,7,8]. This study aimed to present a rare case of cutaneous *D. congolensis* infection in a healthy 30-year-old man with distinct linear crusted lesions and determine its clinical features and microbiological identification to focus on this unusual entity in the differential diagnosis of treatment-refractory dermatitis.

CASE REPORT

This study investigated a 30-year-old healthy man who presented with multiple pruritic, erythematous patches covered with thick yellowish crusts on his face and left arm. The lesions had been present for 1 month. The patient reported a history of a minor scratch on his left arm preceding the eruption. The lesions initially appeared at the site of trauma and subsequently disseminated to his face. Despite 2 weeks of empirical treatment at a local clinic with oral antihistamines, antibiotics, topical antibiotics (mupirocin), and corticosteroids (prednicarbate and diflucortolone valerate), the lesions showed no improvement and continued to spread. Systemic symptoms, including fever and chills, were not observed. The patient was an office worker living in an urban area and denied recent travel or contact with livestock. He reported occasional contact with healthy dogs but showed no evidence of cutaneous infection.

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†Corresponding: Jung-Ho Yoon, Department of Dermatology, College of Medicine, Dong-A University, Busan 49201, Korea.
Phone: +82-51-240-5430, Fax: +82-51-253-0787, e-mail: yoonskin@dau.ac.kr
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Fig. 1. The baseline clinical presentation (A-C) and post-treatment presentation (D-E). The clinical photographs at the initial visit show multiple erythematous crusted patches on the face (A) and left upper arm (B) and a close-up view of the characteristic thick linear crusts on the left forearm (C). Clinical photographs obtained after 1 week of oral doxycycline treatment show significant resolution of exudative crusts on the left upper arm (D) and left forearm (E), leaving only residual faint erythema and post-inflammatory hyperpigmentation.

The physical examination results revealed erythematous exudative patches with thick, adherent, yellowish-brown crusts on the face and left upper arm (Fig. 1 A, B). Notably, the lesions on the left arm showed a linear arrangement, suggesting autoinoculation via scratching (Fig. 1 C). A microbiological examination was performed using a swab from an exudative lesion on the left arm. The sample was inoculated onto a 5% sheep blood agar plate. Initial incubation at a temperature of 30℃ with 5% CO_2 for 24 hours yielded insignificant growth. However, subsequent incubation at a temperature of 37℃ with 2.5% CO_2 for an additional 48 hours resulted in the profuse growth of colonies. The colonies showed several characteristic features, including a rough and wrinkled appearance, dry consistency, adherence to the agar substrate, and golden-yellow pigmentation with β-hemolysis (Fig. 2). The Gram staining results revealed Gram-

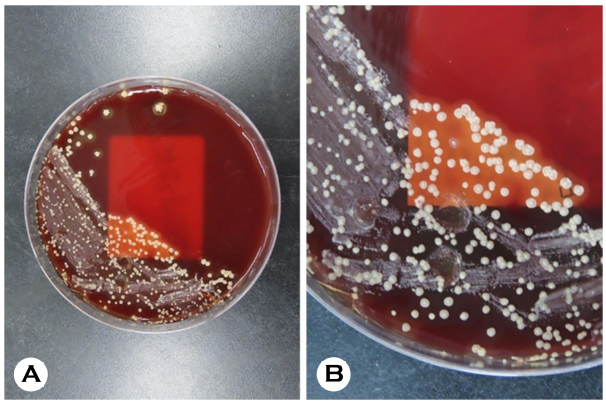

Fig. 2. (A-B) The colony morphology of the isolate culture on 5% sheep blood agar after 48 hours of incubation at a temperature of 37℃ shows characteristic rough, wrinkled, adherent, golden-yellow colonies with β-hemolysis.

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positive organisms with significant pleomorphism. While a few branching filaments were observed, the smear was predominantly composed of fragmented short filaments and coccoid cells arranged in distinctive cuboid packets (Fig. 3). For definitive identification, matrix-assisted laser desorption/ionization time-of-flight mass spectrometry (MALDI-TOF MS) was performed using the VITEK MS system (bioMérieux, Marcy-l'Étoile, France) equipped with the IVD Database v3.2. The analysis identified the isolate as *Dermatophilus congolensis* with a 99.9% confidence level, suggesting a high-confidence identification (Fig. 4). Based on the clinical findings and microbiological confirmation, a diagnosis of cutaneous dermatophilosis was made. The patient was treated with 50 mg oral doxycycline twice daily for 2 weeks. At the 1-week follow-up visit, the exudative crusts and infiltrated plaques were almost completely resolved, indicating a dramatic response to the treatment. However, only residual indistinct erythema and post-inflammatory hyperpigmentation were observed

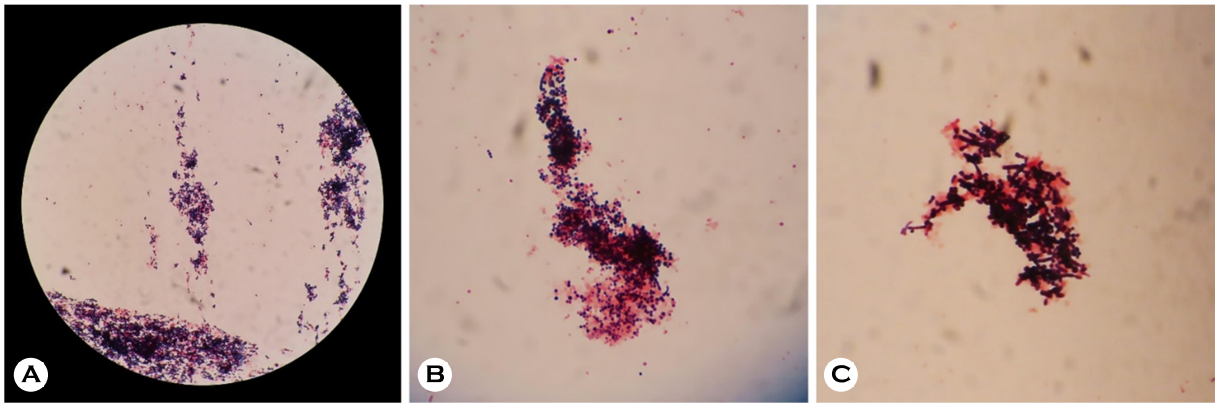

Fig. 3. (A-C) The microscopic morphology of the *Dermatophilus congolensis* isolate. The representative photomicrographs show Gram-positive, pleomorphic organisms (Gram stain, A ×400, B and C ×1,000). (A) The lower magnification view shows the distribution of the organisms. (B-C) Higher magnification views reveal coccoid cells arranged in distinct cuboid packets or clusters, alongside occasional short, fragmented filaments.

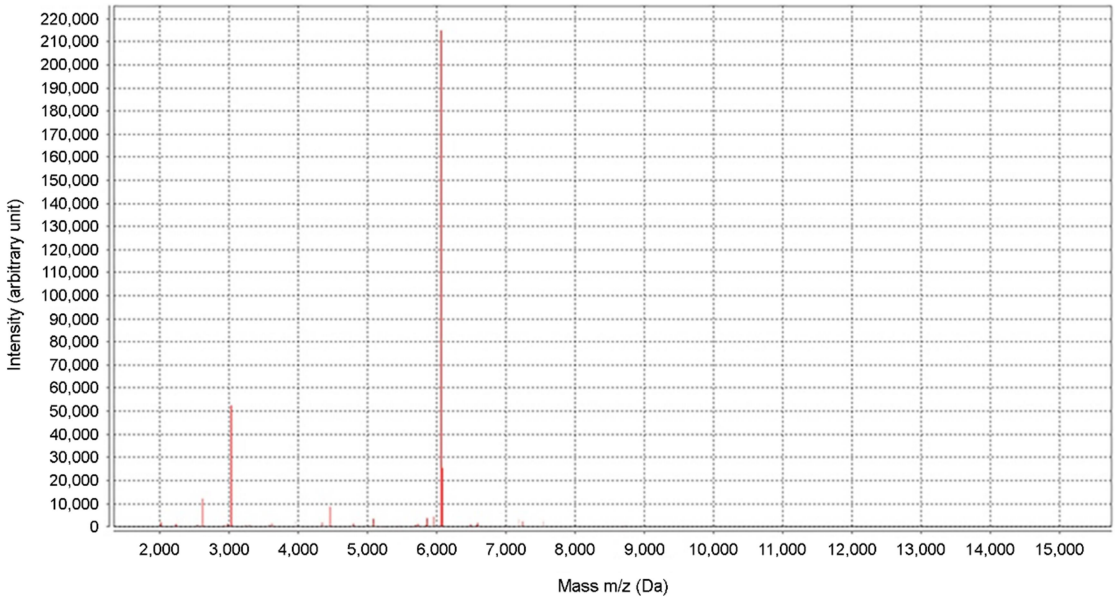

Fig. 4. The identification of the isolate using the VITEK MS system (MALDI-TOF MS)

(Fig. 1 D, E). No recurrence was observed during the 2-month follow-up period.

DISCUSSION

Dermatophilus congolensis is primarily a veterinary pathogen that causes exudative dermatitis[1,2]. Human infection with this pathogen is an exceptionally rare zoonosis, and reports of such cases in urban settings without occupational exposure are more limited[3,5,12]. Owing to its rarity and clinical resemblance to other common cutaneous infections, such as impetigo, contact dermatitis, or dermatophytosis, the diagnosis of human dermatophilosis is frequently delayed or missed[1,4]. The findings of this case report are significant as they describe a rare occurrence of *D. congolensis* infection in a healthy urban male and explain the critical microbiological features that facilitate an accurate diagnosis in the absence of histopathological confirmation. Although direct contact with infected animals, contaminated fomites, or vectors is the usual mode of transmission, the identification of the exact source is often challenging in urban settings[3,8,11]. Irrespective of the vector, penetration in the skin barrier is a prerequisite for infection. Factors such as minor trauma or moisture have been shown to compromise the stratum corneum, facilitating the invasion of motile, infective zoospores into the epidermis[1,2,8]. In the present case, a preceding minor scratch was likely the portal of entry, and the distinct linear distribution of the lesions suggests autoinoculation or a Koebner-like distribution along the line of trauma.

A definitive diagnosis of dermatophilosis relies on isolating the organism or identifying its characteristic morphological features in clinical specimens[1,4,5]. In the present case, microbiological culture played a pivotal role. Nevertheless, our case encountered initial challenges, which have yielded significant insights for clinical laboratories. Although *D. congolensis* is generally known to optimally grow at a temperature of 37℃, routine skin cultures are often processed under protocols for superficial fungal infections, thereby using lower incubation temperatures[2]. Moreover, preliminary incubation at a temperature of 30℃ yielded insignificant growth, which could have been readily disregarded as negative or nonspecific. The characteristic rough, wrinkled, adherent, and golden-yellow colonies with β-hemolysis became prominent only after modifying the incubation condition to a temperature of 37℃ with 2.5% CO_2[1,2,5,7-9]. This observation emphasizes the fact that while the organism may survive at various temperatures, optimal isolation from human skin samples requires a strict adherence to higher incubation temperatures (37℃)[1,2]. Clinicians and microbiologists should be aware of this requirement to avoid false-negative results, particularly when standard empirical treatments fail[1].

Morphologically, *D. congolensis* is unique among the other types of actinomycetes because of its complex life cycle, which entails the maturation of filamentous hyphae into packets of motile zoospores through transverse and longitudinal septations[2]. Histopathologic sections often reveal long, branching filaments with a pathognomonic "tram-track" appearance that invades the stratum corneum[6,8]. However, the Gram staining of our cultured colonies predominantly revealed fragmented short filaments and clusters of coccoid cells rather than lengthy hyphae. This discrepancy likely results from the organism reaching the zoospore stage and the inevitable fragmentation of delicate hyphae during the mechanical disruption of hard, adherent colonies. Crucially, the coccoid cells in our specimen were not randomly arranged, such as in staphylococci, but formed distinct cuboid packets, indicating the characteristic multidimensional septation of *D. congolensis*[2]. This specific arrangement serves as a key differentiating feature from other Gram-positive cocci in culture smears.

Furthermore, this case emphasizes the efficacy of MALDI-TOF MS as a rapid and reliable alternative to labor-intensive molecular methods[5]. The VITEK MS system was used to achieve a definitive diagnosis with 99.9% confidence, consistent with recent reports that support its utility for *D. congolensis*[5]. Although 16S rRNA sequencing was not performed in the present study, the diagnosis was definitive based on the convergence of the high-confidence MALDI-TOF MS results (99.9%), pathognomonic microscopic features (cuboid packets), characteristic colony morphology, and rapid clinical response. Consistent with the findings of recent validation studies, MALDI-TOF MS provides sufficient diagnostic accuracy when corroborated by concordant phenotypic and clinical findings. Consequently, when the clinical and culture findings are compatible, MALDI-TOF MS can be used as a definitive diagnostic tool, potentially sparing patients from undergoing invasive skin biopsies.

CONCLUSION

We propose a practical diagnostic workflow for clinicians encountering refractory cases. The presence of *D. congolensis* should be considered in the differential diagnosis of exudative crusted dermatitis unresponsive to conventional antibiotics and antifungal agents, even in urban patients without direct occupational exposure to livestock. Our findings suggest that incubation at a temperature of 37℃ is essential for optimal

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growth and colony expression. Crucially, when routine fungal cultures (typically incubated at a temperature of 25-30℃) yield negative results despite persistent clinical symptoms, clinicians should explicitly request bacterial culture with incubation at a temperature of 37℃.

Morphologically, the observation of distinct cuboid packets of coccoid cells in culture smears is a consistent diagnostic feature reflecting the organism's life cycle. Finally, MALDI-TOF MS serves as a powerful and accessible tool for definitive identification. The early recognition of these diagnostic pitfalls and an appropriate microbiological workup are essential to ensure rapid recovery with targeted antibiotic therapy.

CONFLICT OF INTEREST

In relation to this article, we declare that there is no conflict of interest.

DATA SHARING STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

ORCID

Jang-Hoon Yi: 0009-0003-5837-1533
Kyung-Deok Park: 0000-0003-1064-5307
Hyeong-Won Hong: 0009-0005-4388-586X
Ki-Ho Kim: 0000-0001-5389-5053
Jung-Ho Yoon: 0000-0001-5756-1341

PATIENT CONSENT STATEMENT

The patient provided written informed consent for the publication and the use of his images.

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