

## Tinea Capitis and Tinea Corporis caused by *Microsporum canis* in an 82-year-old Woman: Efficacy of Sequence Analysis

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Tinea capitis is more common in children than in adults. Due to the low incidence of this condition among adults, it is frequently misdiagnosed as other scalp diseases, such as seborrheic dermatitis, psoriasis, and cellulitis. Herein, we describe an 82-year-old woman who presented with erythematous scaly patches and alopecia. Mycological examinations revealed tinea capitis caused by *Microsporum canis*. The patient was then successfully treated with antifungal medications.

**Key Words:** Fungal infection, *Microsporum canis*, Tinea capitis

### INTRODUCTION

Tinea capitis is a superficial fungal infection of the scalp that is characterized by scaly patches and alopecia. Moreover, this condition is more common in children than in adults<sup>1</sup>. Due to its low incidence, it can be misdiagnosed as other scalp diseases, such as seborrheic dermatitis, psoriasis, and chronic cutaneous lupus<sup>2</sup>. Delayed treatment can result in permanent scarring alopecia. Thus, special attention must be paid to prevent misdiagnosis and inappropriate treatment.

### CASE REPORT

An 82-year-old woman presented with a 6-week history of painful inflammatory erythematous scaly patches and diffuse alopecia. Based on the physical examination, most areas of the frontal scalp were affected, and the patient also

had 1x1-cm erythematous scaly patches with pruritus on the right cheek, right forearm, and back (Fig. 1A-C). However, no lesions were observed on the palms, soles, and nails. The patient farmed in the countryside and did not have any pets. However, she sometimes cleaned up the stools of neighborhood dogs or stray cats that roam around her house. The laboratory examination findings were as follows: C-reactive protein level, 1.19 mg/dL; fasting serum glucose level, 283 mg/dL; and urine glucose, 1+. Moreover, her kidney and liver functions were normal based on blood chemistry test. She had been taking medication for angina pectoris and was newly diagnosed with diabetes mellitus based on the following examination results: postprandial 2-hour blood glucose of 282 mg/dL and hemoglobin A1c level of 6.3 mg/dL. Based on dermoscopic examination, there were comma-shaped and zigzag hairs on the alopecic area (Fig. 2A). According to the Wood's lamp examination, the scalp had yellow-to-green fluorescence (Fig. 2B). After strands of hair and scales were

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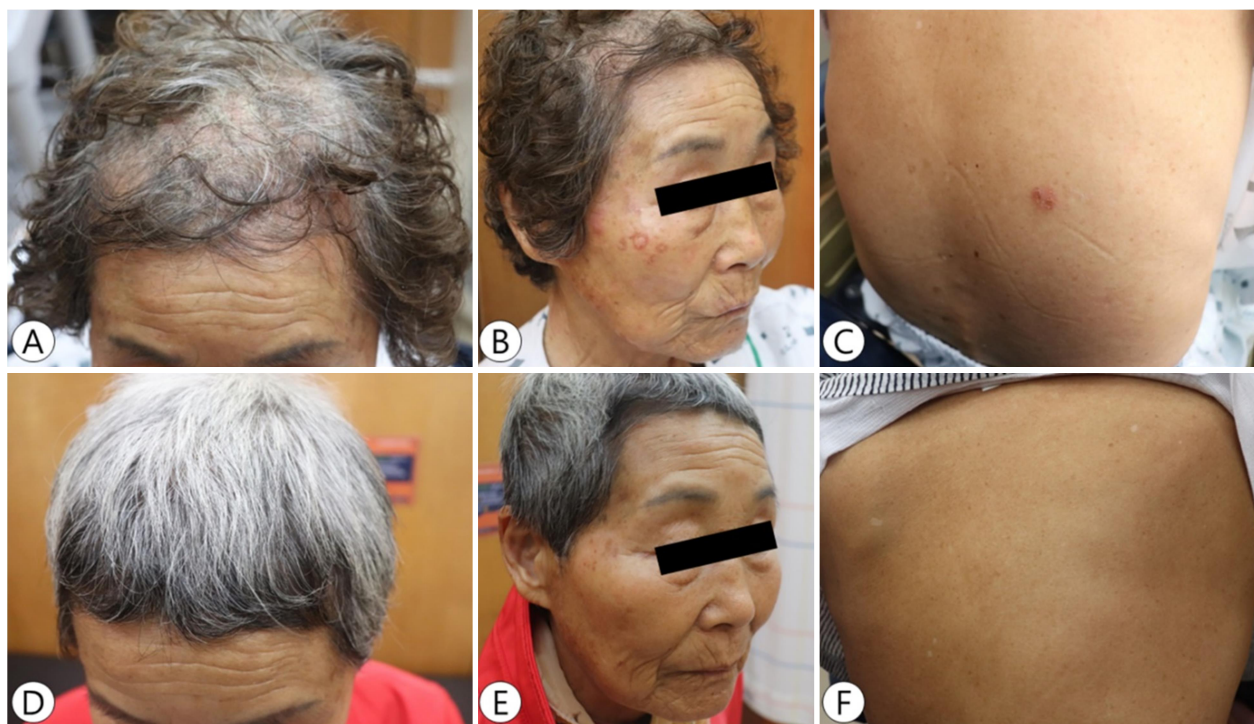


Fig. 1. (A-C) Before treatment, alopecia concomitant with erythematous scaly patches on the scalp and erythematous scaly patches on the face and back are present. (D-F) After treatment, no skin or scalp lesions are seen and there are no complications.

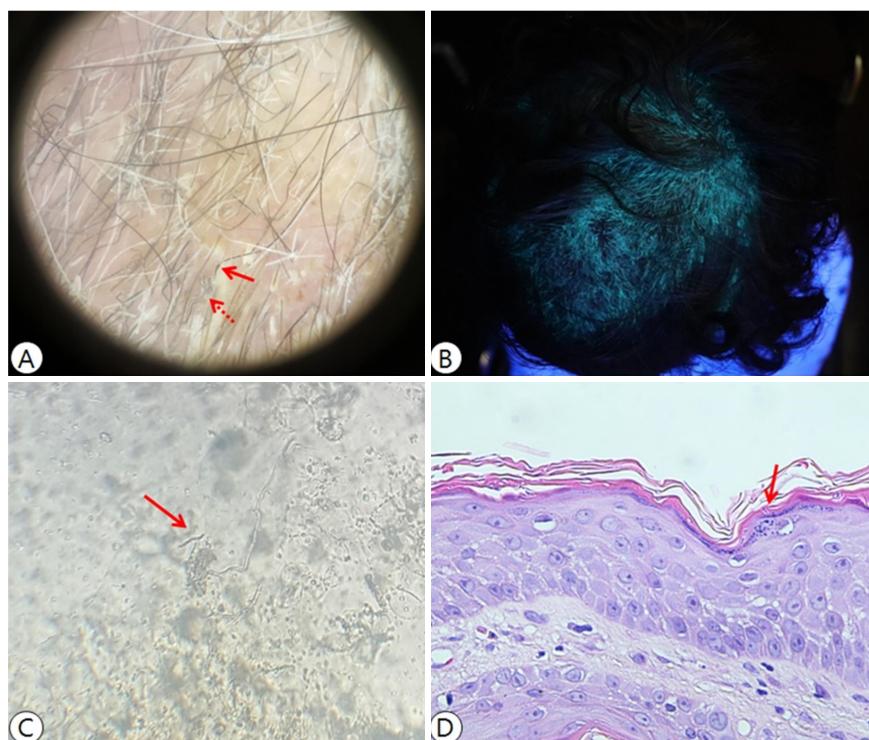
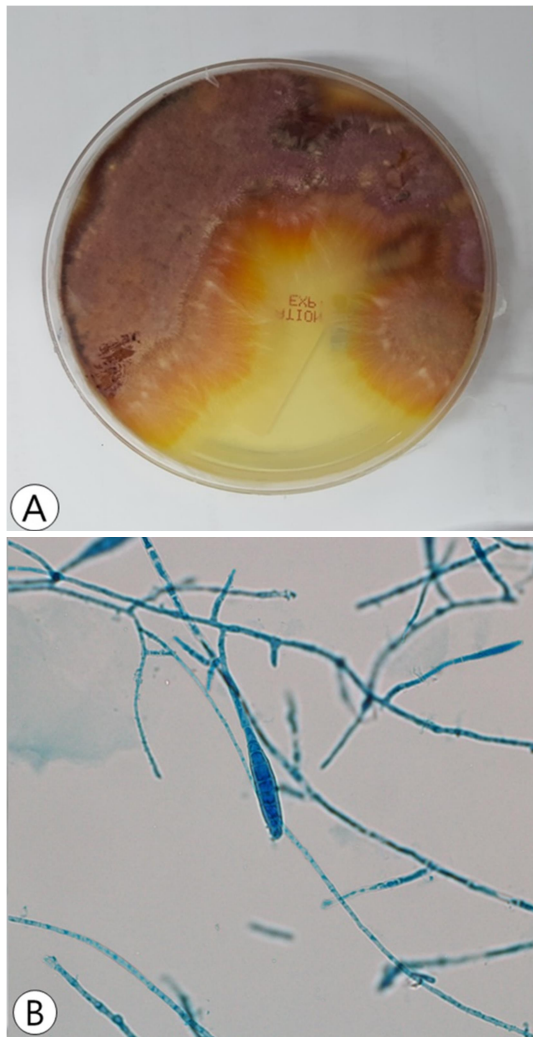


Fig. 2. (A) On dermoscopy, comma-shaped hairs (full arrow) and zig-zag hairs (dotted arrow) are seen in the alopecic area. (B) On the Wood's lamp examination, yellowish-green fluorescence is seen. (C) On the KOH examination, fungal hyphae (arrow) on the outside of hair are seen. (D) On punch biopsy, intracorneal fungal hyphae and spores (arrow) are seen.



**Fig. 3.** (A) On fungal culture in Sabouraud's dextrose agar, fungal colonies that showed red and white cottony colony with maroon reverse pigment. (B) On lactophenol cotton blue stains, fusiform macroconidia with thick or thin echinulate walls containing 5 to 15 cells are seen.

collected from the fluorescent lesions, microscopic examination with 20% potassium hydroxide (KOH) preparation was performed, and results showed fungal hyphae on the outside of the hair (Fig. 2C). In addition, the strands of hair and scales were inoculated in Sabouraud dextrose agar and were incubated at room temperature. After 3 weeks, red and cottony fungal colonies grew, which were indicative of *Trichophyton (T.) rubrum* (Fig. 3A). The microscopic observation of lactophenol cotton blue stain in the colonies revealed a few macroconidia that had fusiform structures containing 5~15 cells, which indicates *Microsporum* (Fig. 3B). Then, a punch biopsy

was performed on the alopecic scalp, which revealed intra-corneal fungal hyphae and spores, consistent with tinea capitis (Fig. 2D). To identify the definite causative organism, polymerase chain reaction and direct sequencing were performed on the cultured fungal colonies, and the fungus was identified as *M. canis*. Based on these results, we made a diagnosis of tinea capitis caused by *M. canis*. The patient was treated with oral terbinafine, topical amorolfine, and topical steroid shampoo with a low-dose systemic steroid for 3 weeks. After 3 months, the subsequent KOH examination result was negative, and symptoms, such as pruritus, erythematous scaly patches, and hair loss, were not observed (Fig. 1D-F). Moreover, the patient did not present with complications, including scarring alopecia.

## DISCUSSION

Tinea capitis is commonly observed in children, and it is rarely observed in adults<sup>1</sup>. This phenomenon is attributed to the relatively immature immune system and low production of sebum in children. Tinea capitis rarely occurs in adults due to the active secretion of fatty acid in the sebum, which has anti-fungal properties, and the fully mature immune system after puberty<sup>3</sup>. However, when the immune system is compromised, adults can easily develop tinea capitis. In our case, the patient was newly diagnosed with diabetes mellitus, which is the common cause of immunosuppression. In particular, post-menopausal women whose secretion of sebum decreases due to hormonal changes are at risk<sup>4</sup>.

In severe cases, the clinical symptoms of tinea capitis include brittle hair, papules, pustules, nodules, and kerion celci, which can leave permanent scarring from alopecia if treatment is delayed. Dermoscopy or trichoscopy can be an effective tool for the diagnosis of tinea capitis and the presence of comma, corkscrew, zigzag, and Morse code-like hair or whitish sheath is indicative of tinea capitis<sup>5</sup>.

When a fungal infection is suspected, the fungal species must be confirmed. The patient's hairs were pulled out and cultured using Sabouraud dextrose agar, and results revealed red and white cottony colonies with maroon-colored reverse pigment. Based on this culture finding, the patient was initially misdiagnosed with *T. rubrum* infection. Therefore, a multi-modal examination was required to identify the causative fungal species. *M. canis* and *T. tonsurans* are the most common pathogens of tinea capitis. In particular, in the case of tinea capitis, KOH examination, fungus culture, Wood's lamp examination, and clinical correlation analysis can be effective in determining the causative fungus. On Wood's



lamp examination, *M. canis*, *M. audouinii*, and *M. distortum* have yellow-green fluorescence<sup>6</sup>. A KOH examination can confirm whether it is an ectothrix or endothrix infection, which can help in determining the causative organism<sup>7</sup>. If an ectothrix infection is identified via KOH examination, as in this case, the causative organisms can be *M. canis*, *M. audouinii*, *M. distortum*, *M. fulvum*, *M. gypseum*, *T. megninii*, and *T. rubrum*. The analysis of clinical correlation is also important. Clinically, zoophilic fungi-like *M. canis* can frequently cause excessive inflammatory reactions, as observed in this case<sup>4</sup>, which often require higher doses and longer courses of antifungal therapy and early steroid treatment to prevent scarring alopecia<sup>8</sup>. Taken together, the Wood's lamp examination, KOH examination, and clinical examination findings indicated that this infection was more consistent with *M. canis* than *T. rubrum*. Therefore, we initiated empirical antifungal treatment based on a putative *Microsporum* infection. To accurately identify the causative fungus, we repeatedly subcultured and observed the organism microscopically, which revealed characteristic spindle-shaped macroconidia containing 5~15 cells. Furthermore, we decided to perform molecular tests, which are extremely effective in identifying the species of the pathogen<sup>9,10</sup>. We performed polymerase chain reaction and direct sequencing on the cultured fungal colonies. First, the nucleotide sequence of the internal transcribed spacer of rRNA gene was obtained. Then, the nucleotide sequence was analyzed using BLAST, and the species was identified as *M. canis*.

*M. canis* is one of the primary causes of tinea capitis worldwide<sup>11</sup>. The number of infections caused by *M. canis*, which was first reported in Korea in 1957<sup>12</sup>, increased rapidly until 1986<sup>13</sup>. However, the trend in *M. canis* infections has decreased as people learn about proper hygiene<sup>13</sup>. *M. canis* infection occurs mainly after close contact with animals, such as dogs and cats<sup>14</sup>. In our case, the patient did not raise pets. However, she claimed that dogs and cats often roam around her house and she cleaned up the waste of these animals with her bare hands. Thus, animal waste was considered the possible transmission route.

In adults, tinea capitis with alopecia should be considered with differential diagnoses of other scalp diseases, such as chronic cutaneous lupus erythematosus, lichen planopilaris, and folliculitis decalvans, which require skin biopsies. Because delayed treatment of tinea capitis can leave permanent alopecia, suspicion, detailed history taking, and fungal tests, as observed in this case, are extremely important. Thus, tinea capitis should be considered in adults who present with hair loss and other scalp diseases, and molecular diagnostic testing is effective in identifying fungal infections.

## CONFLICT OF INTEREST

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

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## PATIENT CONSENT STATEMENT

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

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