

Manifestation of onychomycosis in unilateral toe and finger nails of a one-year-old girl five months after trauma: A case report

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Abstract : A healthy one-year-old girl presented with onychomycosis in the left foot unilaterally, with the toes and all fingers affected. Five months prior to the onset, she had a history of toenail injury. As two months of topical ketoconazole treatment showed no improvement, topical efinaconazole was selected as an alternative to alleviate symptoms. Although onychomycosis in children is extremely rare, trauma is an important predisposing factor. However, the literature is scant. Moreover, as limited data exist on the use of efinaconazole in children younger than six years of age, this case is the first report to suggest its efficacy and safety in a one-year-old infant.

Key words : onychomycosis, tinea unguium, trauma, infant, efinaconazole

爪外傷後の経過フォロー中に乳児に発症した爪白癬の1例

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概 要 : 症例は1歳女児。数カ月前にシュレッダーに左第1趾が挟まれ、爪甲と爪床の断裂を受傷し縫合処置を行った。創傷治癒は良好であり、爪甲の成長を外来で観察していた。受傷から5カ月後に左足全趾に爪白癬を発症した。小児の爪白癬の有病率は低く、渉猟する限り乳児で片側の全趾に病変を認めた報告はないが、外傷は爪白癬の原因の一つとして知られる。本疾患は爪甲の健全な成長を阻害し外傷後の変形しやすい爪甲への影響も大きい。本症例ではケトコナゾール外用にて改善を認めなかったが、小児への使用経験の少ないエフィナコナゾールの外用による治療にて良好な結果を得ることができた。文献的考察を含めて報告する。

索引用語 : 爪真菌症, 爪白癬, 外傷, 乳児, エフィナコナゾール

【Introduction】

Onychomycosis in children is rare, with a prevalence of 0.14% compared to 6.4% in adults¹⁻⁵⁾. Although 65% of patients are infected via familial transmission, which is the most common cause⁶⁾, trauma is another

important predisposing factor^{5,7)}. However, onychomycosis sometimes occurs long after trauma, and patients may not remember their history in such cases⁷⁾. Early diagnosis and treatment are important because onychomycosis can impede nail growth and result in nail deformity.

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As the treatment of onychomycosis requires several months to years, careful selection among the various treatment options is important especially in children⁸⁾. Herein, we report the case of a one-year-old patient with onychomycosis, along with a literature review.

【Case report】

A one-year-old girl without a notable medical history had her left toe caught in a shredder and was transported to the hospital by ambulance in October 20XX. Laceration of the nail plate and bed was observed in the lunula. As the nail plate and nail bed were not separated, only the nail plate was sutured at its lacerated section, with the expectation of a possible approximation of the nail bed (Fig. 1a). Follow-ups at the outpatient clinic were unremarkable for the first month; however, five months after the trauma in March 20XX, the left toe appeared white and dystrophic, accompanied by erythema on the dorsum of the left foot. Subsequently, the nails of the other four fingers were affected. Although the girl wore socks during the fall and winter after the trauma, she began to wear shoes barefoot before the onset of onychomycosis. No family or social history of onychomycosis was noted. The girl visited the dermatology clinic where onychomycosis was diagnosed using potassium hydroxide (KOH) examination and received topical ketoconazole treatment. Two months after treatment, the girl visited our clinic for post-trauma follow-up; however, no improvement was observed in nail appearance. All nails on the left foot appeared white superficially near the proximal nail fold, with nail avulsion in 1st and 5th finger (Fig. 1b). KOH was negative for *Trichophyton*, possibly because of residual topical ketoconazole. However, the rapid antigen test was positive. As superficial white onychomycosis (SWO) was suspected, we decided to continue the topical agent efinaconazole as an alternative. The solution was applied while the girl was asleep to avoid unnecessary contact, and excess solution beyond the lesion was removed to prevent the development of dermatitis, which is an adverse effect. After a month, the lesion progressed distally as the nail grew, with a healthy nail appearing at the proximal end. Further improvement was achieved after two months

without any complications (Fig. 1c,d, Fig. 2b,c). The right foot was not affected throughout each visit (Fig. 1e-g).

【Discussion】

Trichophyton are known to be isolated from almost 100% of floors within the household environment⁹⁾, and anyone has a potential risk of developing onychomycosis. Trauma is an important predisposing factor that increases onychomycosis by 5.4 times⁷⁾. Although the mechanism of posttraumatic onychomycosis development is unclear due to limited literature, the entry of microbes from the microtrauma into the skin has been widely accepted as an etiology¹⁰⁾. Indeed, more than 60% of patients have fissures in the skin¹¹⁾. Moreover, onycholytic nails create a dead space for microbial colonization,⁷⁾ which may be further promoted by slow nail growth after trauma¹²⁾.

Another questionable aspect of traumatic onychomycosis is that sometimes the symptoms occur late after trauma⁷⁾; nevertheless, the incubation period of *Trichophyton* is 12 to 24 h. For the establishment of infection, not only the presence of microbes but also humidity is important¹⁰⁾. High humidity produces macerations that predispose the skin to microtrauma, whereas microbes are less infectious in a dry environment¹³⁾. The optimal humidity under which microbes penetrate the skin has been reported to be 90% to 100%, with no penetration observed at less than 85%¹⁰⁾.

As the humidity in shoes is approximately 100%, shoes are known risks for onychomycosis¹⁴⁾. In contrast, wearing socks decreases onychomycosis by 95%¹⁵⁾.

Collectively, the late onset observed in our case was possibly due to a high-humidity environment created by the acquired habit of walking barefoot in shoes in March. Erythema on the affected foot when onychomycosis develops further suggests the presence of skin microtrauma. During the fall and winter, wearing socks in addition to low humidity would have prevented onychomycosis in the patient. The absence of infection in the right foot might be explained by fewer microbes in the shoes and lower chances of entry compared to the affected left foot with a history of trauma at the toe, in which colonization might have occurred at the deformed nail that could result in more microbes in the shoes.



Fig 1. a: Nail plate and nail bed laceration on the left toe. The nail plate was repaired using a 5-0 nylon suture by approximating the nail bed. Note that photographs before the procedure were not taken. b: Two months after ketoconazole application without improvement (the first visit to our clinic after the onset of onychomycosis). Treatment with efinaconazole solution was started. c, d: At one and two months after the treatment with efinaconazole solution, respectively, showing significant clearance in all digits. e-g: The right foot was not affected throughout each visit.

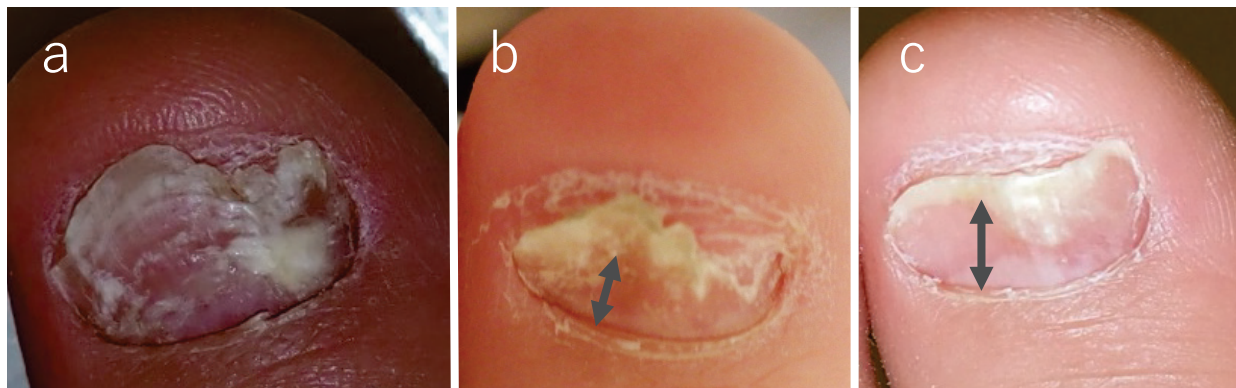


Fig 2. Photographs of the course of healing of the toe on the left foot. a: At the start of treatment with efinaconazole solution. b: Partial clearance was seen at the proximal nail plate after one month. c: Further clearance from the proximal to distal nail plate was obtained after two months. The change in the length of double arrows shows the growth of the clear nail.

Moreover, in addition to microtrauma to the skin of the left foot, fissures on the deformed nail also increase the chance of microbial invasion. Given that posttraumatic onychomycosis usually affects a single digit with the most common site of the toe in 66% of cases and rarely spreads beyond the toe¹⁶⁾ as only 3% show multiple finger involvement⁵⁾, the involvement of all fingers unilaterally in our case is quite rare. The mechanism for this remains unsolved; however, the entry of microbes from the affected

toe through microtrauma in the fingernails or skin induced by maceration and friction in shoes can be a possible explanation.

The mainstay of treatment for SWO is the application of topical agents, as *Trichophyton* localizes superficially¹⁷⁻¹⁹⁾. Efinaconazole is a topical solution with high efficacy for healthy nail growth and clearance²⁰⁾. It is effective even in cases resistant to systemic therapy¹⁹⁾. Although its efficacy has not been established in children younger than

six years of age²¹⁾ due to limited data, its adverse effects are localized to dermatitis and itchiness, which can be prevented by removing the solution exceeding the target site. Our patient showed a poor response to conventional topical therapy; however, efinaconazole alleviated the symptoms without complications.

【Conclusion】

Although rare, onychomycosis can also occur in infants. Trauma is a predisposing factor that can result in late-onset onychomycosis, and long-term follow-up is important after trauma. Our case suggests that efinaconazole is effective even in onychomycosis resistant to conventional therapy and can be used safely in infants.

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