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CASE REPORT

A case series on pediatric tinea capitis

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ABSTRACT

Tinea capitis, a dermatophyte infection of the scalp mainly caused by zoophilic and, less commonly, anthropophilic species, predominantly affects prepubertal children. Clinically, it presents with scalp scaling, hair loss, alopecia with scaly plaques, or alopecia with "black dots" from broken hairs at follicular openings. Severe forms, such as tinea profunda, may progress to suppurative lesions, pustules, and thick crusts. Standard systemic treatments include terbinafine, itraconazole, fluconazole, and griseofulvin (currently unavailable in Poland). The choice and duration of therapy depend on the infection severity and dermatophyte species. This case series of five pediatric patients illustrates the varied clinical presentations of tinea capitis and highlights the importance of early diagnosis and prompt systemic antifungal therapy to prevent irreversible outcomes, including permanent alopecia and scarring. The review of clinical cases and literature underscores that timely and adequate therapeutic intervention is essential to optimize outcomes in the affected children.

KEY WORDS:
dermatophytes, itraconazole, terbinafine, tinea capitis, kerion.

INTRODUCTION

Tinea capitis, a fungal infection of the scalp caused predominately by zoophilic (*Microsporum canis* or *Trichophyton mentagrophytes)* or rarely by anthropophilic (*T. tonsurans* or *T. rubrum*) dermatophytes, affects the pediatric population, particularly prepubertal children [1, 2]. It is the most common infectious cause of alopecia in children aged 3–10 years [3]. Clinically, it may present as hair loss accompanied by scalp scaling, alopecia with scaly patches, or alopecia with "black dots" at the site of hair follicles [4]. In more severe cases, the scalp can develop pustules, crusts, and abscesses [5]. Early recognition and treatment are crucial to prevent long-term sequelae, including permanent alopecia and scarring [6]. The main antifungal treatments for tinea capitis include griseofulvin, terbinafine, itraconazole, and fluconazole [7]. The choice and duration of treatment depend on the type of dermatophyte and the severity of clinical presentation [6]. This case series highlights the varied clinical manifestations of tinea capitis and emphasizes the importance of prompt systemic antifungal therapy to mitigate potential complications.

MATERIAL AND METHODS

Medical records of five patients diagnosed with tinea capitis between January 2022 and June 2024 at the De-

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partment of Dermatology, Pediatric Dermatology and Oncology, Medical University of Lodz, Poland, were included in this retrospective case series. Diagnosis of tinea capitis was established on the basis of clinical presentation and physical examination findings. Mycological confirmation was sought using direct microscopic examination with potassium hydroxide (KOH) preparation, fungal culture and molecular examination using polymerase chain reaction (PCR). In cases with negative mycological tests, the diagnosis was retained on the basis of a strong clinical and epidemiological evidence. Collected data included patient age and sex, symptoms, clinical morphology, relevant epidemiologic exposures, laboratory and mycological findings, treatment type and duration, clinical outcomes, adverse events, and photographic documentation. Patients attended regular monthly follow-up visits during the treatment, at which clinical response and safety (assessment of patient-reported adverse events and monitoring of routine blood laboratory tests) were evaluated.

For all patients, systemic antifungal therapy was initiated based on disease severity and clinical form. Treatment regimens were individualized in accordance with current clinical practice and available literature. Dosage adjustments were made according to body weight, and when fixed doses were used, they were verified to fall within the recommended mg/kg/day therapeutic range. The duration of systemic therapy depended on the clinical response and was extended until complete remission was observed.

All patients received adjunctive topical antifungal therapy as part of a combined treatment strategy. Topical agents included antifungal creams or gels (e.g., miconazole, isoconazole, clotrimazole), ketoconazole or clotrimazole shampoos, antiseptic compresses (e.g., Argentum nitricum 0.1%), and, when indicated, anti-inflammatory compound preparations. The aim of topical therapy was to reduce fungal load, improve local inflammation, and prevent reinfection. Preventive measures were implemented systematically in all cases.

These included clinical screening of household contacts for asymptomatic carriers, recommendation of mycological testing in close family members when clinically indicated, inspection of pet animals by a veterinarian when exposure was suspected, and disinfection or replacement of hair care items (combs, brushes, hats, bedding). Caregivers were educated on hygiene practices to minimize the risk of reinfection or transmission.

CASE REPORTS

CASE 1

A 3-year-old girl presented with erythematous nodules on the scalp, exuding purulent discharge and covered with thick crusts. These lesions appeared two weeks prior to admission, initially manifesting as blisters. Her medical history included a diagnosis of seborrheic dermatitis, which had been treated topically. Additionally, the family's pet dog had been diagnosed with a fungal infection, suggesting a potential zoonotic source. Laboratory findings revealed mildly elevated C-reactive protein (CRP) levels, while other results were within normal limits. A direct mycological examination under an optical microscope, following the application of a 20% KOH solution, detected the presence of hyphae and small spores within the hair while the fungal culture result was negative. Due to the positive result of direct mycological examination and the clinical presentation suggestive of deep cutaneous mycosis (kerion), oral antifungal therapy with itraconazole was initiated at a dose of 5 mg/kg body weight per day (daily dose: 100 mg/day). In addition to systemic antifungal therapy, topical treatment was introduced. The patient received wet compresses with 0.1% Argentum nitricum solution applied twice daily to the affected scalp area for 30–60 minutes, continued for approximately one month. Immediately after removal of the compress, topical miconazole gel was applied to enhance local antifungal activity and promote lesion resolution. Furthermore, a minor, atraumatic, limited debridement of the overlying crusts was performed to facilitate drainage and promote healing. The patient showed mild improvement in skin lesions, with a negative direct mycological examination using a 20% KOH solution after two months. Laboratory monitoring demonstrated no abnormalities, particularly with respect to hepatic enzymes, including alanine transaminase and aspartate transaminase, as well as creatinine levels and complete blood count parameters. Despite a negative direct mycological examination during follow-up, itraconazole therapy was continued for six months until full clinical remission was achieved. No adverse effects of therapy or subsequent abnormalities in blood laboratory parameters were observed throughout the remainder of the treatment period. At a follow-up visit twelve months after discontinuation, the patient remained in remission, with mild scalp scaling and hair regrowth without scarring.

CASE 2

A 6-year-old boy presented with three bald patches on the parietal scalp, persisting for four months despite topical treatment. His sister had similar lesions, suggesting a possible contagious source of infection. A direct mycological examination and fungal culture results were negative. However, molecular examination using PCR was positive for general dermatophytes. Moreover, the Wood's lamp examination revealed a characteristic blue-green fluorescence typical for dermatophytes. The patient was otherwise healthy, with no laboratory abnormalities. Initially, the patient was treated with oral terbinafine at a dose of 125 mg/day. However, due to

insufficient clinical response after one month, the treatment was supplemented with oral itraconazole at a dose of 5 mg/kg body weight/day (daily dose: 100 mg/day). In addition to systemic antifungal therapy, topical treatment was administered. For the first two weeks, the patient received daily applications of a compound topical preparation containing phenol, resorcinol, and boric acid, aiming to reduce inflammation, desquamation, and bacterial colonization of the scalp. After completion of this phase, topical miconazole was applied twice daily for a total of three months to maintain antifungal activity and prevent recurrence of infection. The patient's laboratory tests, including liver and kidney function parameters as well as complete blood count, were regularly monitored and revealed no clinically significant abnormalities. After two months of combined therapy, both the Wood's lamp examination and the culture result were negative, leading to the discontinuation of treatment after a total of three months of systemic antifungal therapy. No side effects were noted. At a follow-up visit six months after discontinuation of therapy, complete hair regrowth was observed.

CASE 3

A 6-year-old girl presented with an erythematous, scaly lesion on the scalp. Laboratory findings indicated leukocytosis of $20.2 \times 10^3/\mu l$, while the rest of the tests were normal. A direct mycological examination using a 20% KOH solution was positive, revealing the presence of hyphae and spores within the hair. The fungal culture result confirmed *Trichophyton spp.* The patient was initially treated with oral terbinafine at a dose of 125 mg/day for three months. Routine monitoring of laboratory tests including liver and kidney function parameters as well as complete blood count showed no abnormalities. However, after limited improvement, the therapy was switched to oral itraconazole at a dose of 5 mg/kg body weight/day (daily dose: 100 mg/day). In addition to systemic antifungal therapy, topical isoconazole was applied once daily to the affected scalp areas for three months to enhance local antifungal activity and prevent recurrence. After three months of systemic itraconazole therapy, significant clinical recovery was achieved, including full hair regrowth with minimal peeling. No side effects of treatment were noted. At the time of data collection, the patient was still undergoing therapy, having already achieved marked clinical improvement and full hair regrowth.

CASE 4

An 8-year-old boy presented with scalp and trunk lesions, including a tender nodule on the scalp covered by a yellow crust. The lesions developed over the course of a month. Laboratory findings indicated an elevated CRP level of 11.90 mg/l, while the rest of the laboratory test were normal. A direct mycological examination using a 20% KOH solution was positive, revealing the presence of hyphae and spores within the hair. Fungal culture confirmed the presence of *Microsporum canis*. The patient was treated with oral terbinafine at a dose of 125 mg/day and oral itraconazole at a dose of 4 mg/kg body weight/day (daily dose: 100 mg/day) for a total of six months. Laboratory tests were monitored regularly every 4 weeks during therapy with no abnormalities. In addition to systemic antifungal therapy, a complex topical regimen was implemented. The patient received 0.1% Argentum nitricum compresses applied twice daily to the scalp for 30–60 minutes over two months. Additionally, ketoconazole shampoo was used two to three times per week, and isoconazole cream was applied once daily to the external, hairy scalp areas. After two months, emollients were added to improve scalp hydration. Following one month of treatment, a compound topical preparation containing phenol, resorcinol, and boric acid was introduced twice daily for two weeks, followed by isoconazole for another two weeks. This alternating regimen was then repeated, reintroducing the compound preparation twice daily for a further two weeks. During the course of treatment, negative results were achieved from both the fungal culture and the direct mycological examination with a 20% KOH solution, prompting the completion of antifungal therapy. No adverse effects were observed. At a follow-up visit three months after discontinuation of therapy, the patient demonstrated hair regrowth with minimal peeling and slight scarring.

CASE 5

An 8-year-old girl presented with erythematous, scaly lesions and multiple bald patches on the scalp, along with two tender, pus-filled nodules and cervical lymphadenopathy. The patient lived in a rural area, where there were farm animals. Laboratory findings indicated elevated inflammatory markers (CRP at 25 mg/l, leukocytosis of $14.1 \times 10^3/\mu l$), while the rest of the laboratory tests were normal. A direct mycological examination using a 20% KOH solution was positive, revealing the presence of hyphae and spores within the hair while the fungal culture result was negative. Due to the positive direct mycological examination result, despite the negative fungal culture result, the antifungal treatment was implemented. The patient was initially treated with oral terbinafine at a dose of 125 mg/day and oral fluconazole at a dose of 3.5 mg/kg body weight/day (daily dose: 100 mg/day). After one month, fluconazole was discontinued due to normalization of inflammatory markers, and treatment with terbinafine continued. Despite some improvement, persistent nodules required the addition of oral itraconazole at a dose of 5 mg/kg body weight/day (daily dose: 200 mg/day). Laboratory tests were conducted at four-week intervals, consistently demonstrating values within

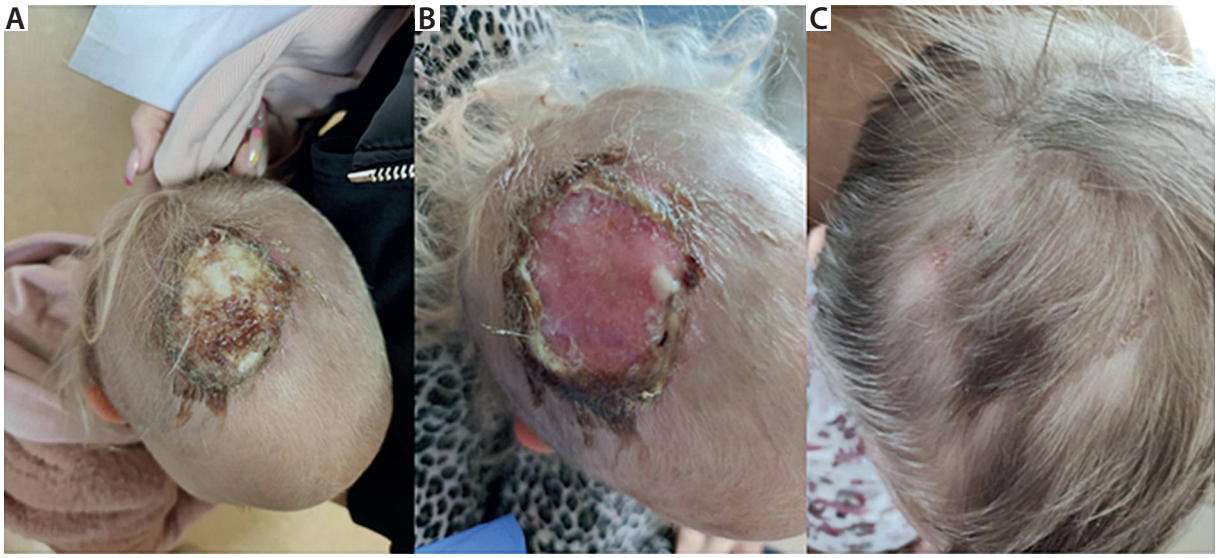

FIGURE 1. **A**) Clinical presentation of cutaneous lesions in Patient 1 – nodular lesions on the scalp with purulent discharge, covered by thick crusts. **B**) Clinical appearance in Patient 1 following surgical debridement of thick crusts covering the nodules. **C**) Clinical remission in Patient 1, with mild scalp desquamation observed after six months of oral itraconazole therapy

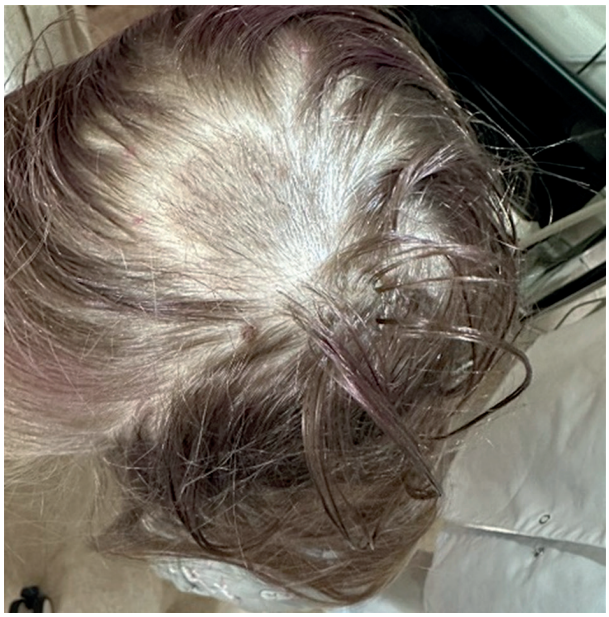

FIGURE 2. Clinical remission was achieved after three months of antifungal therapy in Patient 3, with complete hair regrowth and absence of visible scarring

the established reference ranges. In addition to systemic antifungal therapy, an extensive topical treatment protocol was implemented. Initially, isoconazole and iodine compresses were applied; however, due to lack of improvement and progression of lesions, the regimen was modified. Compresses with 0.1% Argentum nitricum were introduced twice daily for 30 minutes on the scalp for four months, combined with isoconazole cream applied once daily to the scalp and clotrimazole cream applied once daily on the external scalp areas. Additionally, protective compresses with chlorophyll ointment were applied once daily for 30 minutes, and ketoconazole shampoo was used as an adjunctive therapy. After one month, the regimen was adjusted to the use of clotrimazole shampoo once daily in the evening and miconazole cream once daily. After three months, clotrimazole shampoo and topical formulations were maintained, later reduced to two to three times per week for maintenance. After five months of combined therapy, marked clinical improvement was observed. Terbinafine was discontinued, and itraconazole was continued. During the course of itraconazole therapy, the patient developed an episode of urticaria. Considering the significant clinical improvement, lesion resolution, partial hair regrowth, and the urticaria episode, itraconazole therapy was discontinued. At a follow-up visit eight months after the discontinuation of therapy, no scalp lesions were observed (Figures 1–5, Table 1).

DISCUSSION

Early recognition of tinea capitis in the pediatric population is critical to avoid delays in the initiation of antifungal systemic therapy. As demonstrated in the five case reports, prolonged antifungal treatment may be necessary for severe cases. We further explore the safety and efficacy of extended systemic antifungal therapy in pediatric patients with tinea capitis, including atypical clinical presentations reported in the literature. Systemic therapy remains the most effective treatment for tinea capitis, particularly for long-term regimens. In the presented cases, systemic treatment ranged from four to eight months. Four of five patients finished antifungal therapy before the analysis, and one patient was still undergoing antifungal therapy at the time of the analysis. The primary antifungal agents included terbinafine, itraconazole, and fluconazole. Each drug exhibits distinct pharmacologic properties, varies in the duration of treatment, and presents different side effect profiles [8].

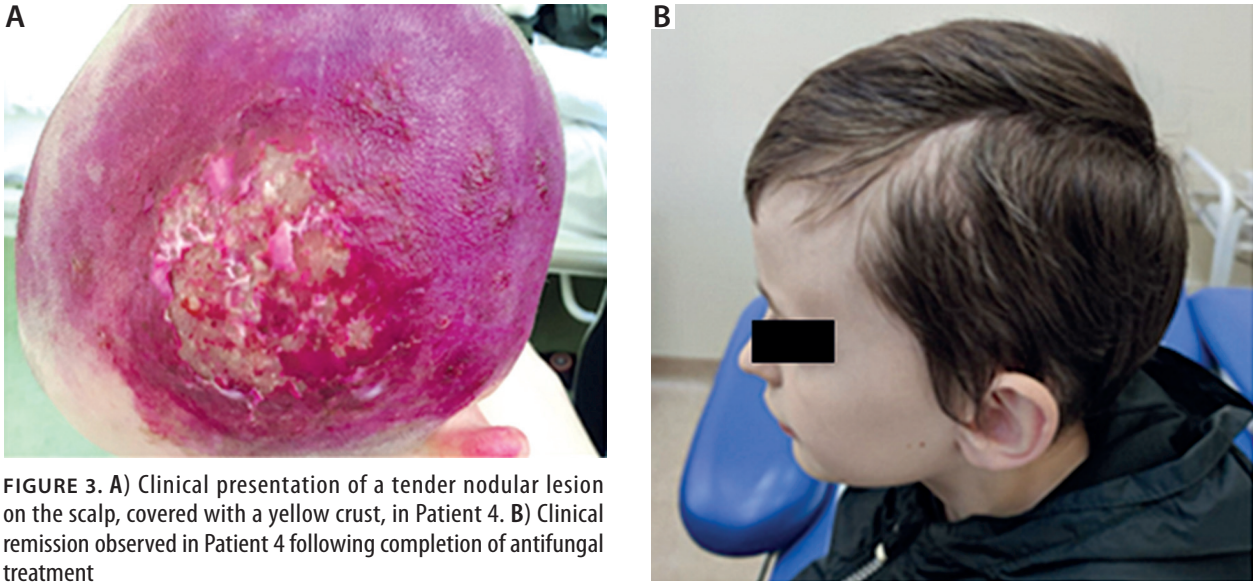

FIGURE 3. **A**) Clinical presentation of a tender nodular lesion on the scalp, covered with a yellow crust, in Patient 4. **B**) Clinical remission observed in Patient 4 following completion of antifungal treatment

FIGURE 4. **A**) Clinical presentation of Patient 5 showing scaly lesions and purulent nodules covered with crusts. **B**) Clinical appearance of Patient 5 after three months of antifungal therapy, demonstrating significant improvement. **C**) Post-treatment remission in Patient 5 with evident hair regrowth

Some of the presented patients required prolonged systemic therapy or combination treatment to achieve complete clinical resolution due to severe or atypical presentations. All patients were closely monitored every 4 weeks throughout the course of systemic antifungal therapy. Regular assessments included liver and renal function tests, as well as complete blood counts, with particular attention to hepatic monitoring in those receiving terbinafine or itraconazole and renal monitoring in patients treated with fluconazole. Importantly, all laboratory values remained within reference /ranges. Only one 8-year-old female patient developed an adverse event – urticaria during the course of itraconazole treatment. In other patients, no clinically significant adverse events were observed, supporting the safety of prolonged systemic antifungal therapy in pediatric patients when carefully supervised.

Terbinafine, classified as an allylamine antifungal agent, belongs to a newer class of ergosterol biosynthesis inhibitors [9]. It is effective against a broad spectrum of dermatophytes, with greater efficacy against *Trichophyton species* than *Microsporum species* [10]. The recommended treatment dose for tinea capitis is weight-dependent: < 20 kg: 62.5 mg/day, 20–40 kg: 125 mg/day, and > 40 kg: 250 mg/day for four weeks [6, 11]. As terbinafine undergoes hepatic metabolism, monitoring liver function is essential during treatment. Skin reactions such as urticaria, erythema, pruritus, acute generalized exanthematous pustulosis, subacute cutaneous lupus erythematosus, and papulosquamous eruptions have been documented as potential adverse effects [12, 13]. In a comparative clinical trial conducted in pediatric patients in China, terbinafine demonstrated comparable efficacy and safety to a four-week course of griseofulvin when used for two to four weeks [14]. In our study,

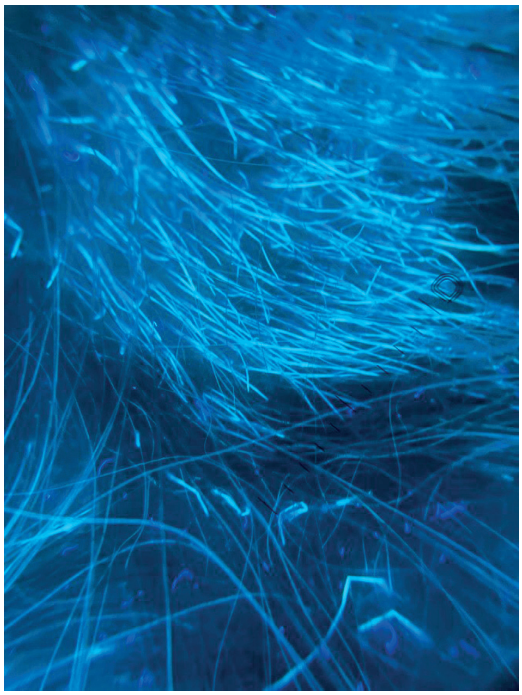

FIGURE 5. The Wood's lamp examination in Patient 2 revealed characteristic blue-green fluorescence

four of five patients were treated with terbinafine at a dose of 125 mg/day, with no side effects and no abnormalities in routine blood laboratory tests.

Itraconazole, another antifungal agent used in our case series, belongs to the synthetic azole class of drugs and is the preferred treatment in many European countries [15]. It is effective against both *Microsporum* and *Trichophyton species* [16]. Like terbinafine, itraconazole undergoes hepatic metabolism, making regular liver function monitoring necessary during therapy. The most common adverse effects are gastrointestinal disturbances, such as nausea, mild diarrhea, vomiting, and abdominal pain. Less commonly, hypersensitivity reactions, including urticaria, may occur**.** Hepatotoxicity and cardiotoxicity are rare but potentially serious complications [5]. The recommended dosage is 5 mg/kg/day [17]. A 2021 study suggested that pulse therapy with itraconazole, administered with a three-week interval between doses, is a safe and effective regimen for managing tinea capitis in children, offering an alternative to daily administration [18].

Although itraconazole is officially approved for use in children aged 16 years and older, we used it off-label in younger children after obtaining informed consent from the child's legal guardian(s). We treated children as young as three years old, based on available literature reports describing its use in younger age and our clinical experience. A review of 45 articles on itraconazole use in infancy reported it to be safe and effective at dose of 5 mg/kg per day for short courses in superficial fungal infections and 10 mg/kg per day for systemic infections [19]. In a case series of seven infants (3–46 weeks old) with tinea capitis caused *by Microsporum canis*, itraconazole at a dose of 5 mg/kg/day led to successful outcomes without adverse effects [20]. In a case series of older children (3–5 years), itraconazole at a dose of 100 mg/day was administered to five patients, with one patient experiencing nausea and ended the treatment early, while the others achieved mycological and clinical cure after 28–112 days of therapy with oral itraconazole [21]. All of our patients were treated with itraconazole at a dose of 5 mg/kg body weight/day. One patient was treated with itraconazole only. All patients from our series tolerated the treatment well, and no abnormalities were observed in routine blood laboratory tests. Treatment with itraconazole was discontinued in only one case, an 8-year-old male patient, due to the development of urticaria five months after initiating the therapy

Based on our observations, the combination of terbinafine and itraconazole was the preferred therapeutic approach for more severe cases of tinea profunda, yielding excellent clinical outcomes in four patients. The treatment demonstrated a favorable safety profile, supported by regular monitoring through routine blood laboratory assessments.

Griseofulvin was historically the first-line treatment for over 50 years. Clinical studies now show that itraconazole and terbinafine offer superior efficacy compared to griseofulvin [8]. Griseofulvin remains highly effective for infections caused by *Microsporum species*, with a recommended dosage of 10 mg/kg/day for 6–8 weeks [6]. Similar to other antifungals, liver function monitoring is required. Potential side effects include headaches, gastrointestinal disturbances, and cutaneous eruptions [22]. A retrospective cohort study found terbinafine to be

TABLE 1. Characteristics of patients with tinea capitis

Patient no.	Age (years)	Sex	Dose of itraconazole [mg/d]	Dose of terbinafine [mg/d]	Dose of fluconazole [mg/d]	Adverse reaction	Duration of therapy (months)	Follow-up
1	3	F	100	–	–	None	6	No relapse
2	6	M	100	125	–	None	3	No relapse
3	6	F	100	125	–	None	6	No relapse
4	8	M	100	125	–	None	6	No relapse
5	8	F	200	125	100	None	5	No relapse

F – female, M – male

the most effective agent against *Trichophyton tonsurans*, achieving clinical clearance in 95% of patients, compared to 68% for fluconazole and 38% for griseofulvin. For patients with *Microsporum canis* infections, griseofulvin and fluconazole demonstrated similar efficacy (73% and 66%, respectively) [23]. Since griseofulvin is no longer utilized in Poland, none of our patients underwent that treatment.

Fluconazole, though used in only one of the cases presented here, is another systemic antifungal option. It belongs to the synthetic azole class and is primarily excreted *via* renal excretion, necessitating dosage adjustments in patients with renal impairment [7]. Therefore, during fluconazole therapy, regular monitoring of renal function parameters, particularly serum creatinine, is necessary. Gastrointestinal symptoms are the most frequently reported adverse events of fluconazole treatment, including nausea, abdominal pain, vomiting, and diarrhea [6]. The recommended dose for tinea capitis is 3–6 mg/kg/day for 6–8 weeks [7]. A 2021 study highlighted the successful use of fluconazole in two infants with tinea capitis, demonstrating shorter treatment duration and high efficacy with minimal side effects [24]. Fluconazole was used in only one of our cases at a dose of 3.5 mg/kg body weight/day, with no side effects.

Tinea capitis can present with atypical clinical features that may delay proper diagnosis and treatment. Ion *et al.* [6] described the case of an eight-year-old boy with multiple fluctuant nodules on the scalp, purulent discharge, yellow crusting, alopecia, and regional lymphadenopathy. A similar lesion developed in the patient's brother. Prior to admission, the patient received meropenem, which exacerbated the scalp lesions [6]. The diagnosis of superinfected tinea capitis, specifically the kerion celsi variant, was confirmed. Treatment involved surgical debridement, terbinafine (125 mg), fluconazole (6 mg/kg body weight/day), gentamicin (7.5 mg/kg/day), and meropenem (10 mg/kg/day) [6]. After initiating therapy, the patient developed a polymorphic erythematous rash that resolved following corticosteroid administration. The authors suggested terbinafine as a potential trigger for this adverse reaction [6]. Chokoeva *et al.* [25] presented the case involving a five-year-old patient with a severe indurated, erythematous plaque on the left temporal scalp, initially mistaken for a mild dandruff-like eruption. The lesion, associated with significant inflammation and hair loss, tested positive for *Trichophyton verrucosum* on mycological examination [25]. A diagnosis of tinea capitis profunda was made, and systemic terbinafine (125 mg/day) led to marked clinical improvement within two months of therapy [25].

CONCLUSIONS

Tinea capitis remains a significant diagnostic and therapeutic challenge in pediatric patients due to its varied clinical presentation, which can closely mimic other skin conditions. Severe cases are often misdiagnosed as bacterial infections, leading to ineffective antibiotic treatment and delayed initiation of necessary systemic antifungal therapy. Additionally, the treatment of more severe cases of tinea capitis, particularly deep fungal infections, remains challenging, as the standard duration of therapy is often insufficient to achieve negative mycological results or complete clinical resolution. Our study describes five pediatric cases, ranging from ages three to eight, presenting with different forms of tinea profunda. In each case, prolonged systemic antifungal treatment led to excellent clinical outcomes, with hair regrowth achieved in all patients. Given the prolonged duration of antifungal therapy, regular monitoring of complete blood count and hepatic and renal function is recommended. Only one patient developed urticaria as a side effect of itraconazole treatment. In the remaining patients, no abnormalities were detected on clinical examination or laboratory testing, further supporting the safety of prolonged systemic antifungal therapy in pediatric patients when clinically indicated. Only one patient experienced minor scarring. Given the established efficacy of terbinafine and itraconazole, this combination may be considered an effective therapeutic option in selected patients, within the limitations of this observational case series. Early identification of tinea capitis in children is essential to avoid delays in treatment and reduce the risk of complications such as permanent scarring and alopecia.

DISCLOSURES

1. Institutional review board statement: Not applicable.
2. Assistance with the article: None.
3. Financial support and sponsorship: None.
4. Conflicts of interest: None.

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