Tinea in Tots: Cases and Literature Review of Oral Antifungal Treatment of Tinea Capitis in Children under 2 Years of Age

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Tinea capitis is a fungal infection classically affecting children at ages 3-7 years and rarely has been reported in children less than 2 years of age.[1,2] The most common etiologic agents in the US are *Trichophyton tonsurans* and *Microsporum canis*.[3] Pathogens vary and country of origin should be considered when investigating the causative organism. Occasionally, *Trichophyton rubrum*, *Trichophyton mentagrophytes*, *Trichophyton violaceum,* and *Trichophyton Sudanese* can trigger outbreaks of tinea capitis that are indistinguishable from *T tonsurans* and are associated with immigrants from the Mediterranean, Eastern Europe, and Central Asia.[4-6] Other commonly identified dermatophytes associated with tinea capitis outside of North America include *T tonsurans, T mentagrophytes,* and *Microsporum audouinii*. In general, black children have a higher incidence of tinea capitis compared with other racial groups.[3]

Specific data on tinea capitis in the 0- to 2-year age group are lacking because of the low reported prevalence of tinea capitis at this age. However, tinea capitis in infants has been recognized since the 1950s.[7,8] Clinical findings for tinea capitis in infants are similar to older children and include alopecia, scaling/flaking, and lymphadenopathy. However, these findings likely are confused with more common conditions such as seborrhea or eczema leading to misdiagnosis and mistreatment.[9]

Management using topical agents, although posing less drug-related risk, is less effective for tinea capitis,[1] and oral antifungal therapy is the standard. In infants, use of systemic drugs has been off-label with no Food and Drug Administration-approved agents or treatment guidelines for this age group. Tinea capitis in infants likely is misdiagnosed and underreported. We present cases of infants with tinea capitis who were treated successfully with systemic agents, review the literature, and provide recommendations on the treatment of tinea capitis in children younger than 2 years of age.

Cases

Case 1

A healthy 12-month-old Caucasian girl was evaluated for an expanding annular, scaly, red plaque lesions on the scalp (**Figure 1**, A; available at www.jpeds.com). She was treated initially for bullous impetigo with oral cephalexin without improvement. Microscopic examination of a potassium hydroxide (KOH) slide preparation showed broken hairs and spores. Fluconazole 5 mg/kg/day was administered orally in a single daily dose. A fungal culture grew *M canis*. The infant's scalp cleared in 3 weeks, and fluconazole was continued for a total of 6 weeks. Her scalp was clear on follow-up examination 3 months later (**Table I**).

Case 2

An 18-day-old African American boy was evaluated for erythematous, scaly patches on the scalp (**Figure 1**, B) that were concerning for seborrheic dermatitis. No lymphadenopathy was noted. Treatment with moisturizers failed to yield improvement. Fungal culture was performed and revealed *T tonsurans.* He was treated with 5 mg/kg/day of fluconazole for 6 weeks. The scalp eruption cleared without any events during therapy (**Table I**).

Case 3

A 14-day-old Caucasian boy was evaluated for an expanding, annular plaque on the scalp (**Figure 1**, C and D). Microscopic examination of a KOH slide preparation showed broken hairs and spores. A fungal culture performed grew *M canis*. The infant was treated with 15 mg/kg/day of griseofulvin ultramicrosize tablets crushed and given orally for 10 weeks with clearance and no recurrence at 3 months of follow-up.

Case 4

A 16-month-old African American girl was evaluated for scaly patches on the scalp with associated hair loss. The patient was treated for "eczema" with topical corticosteroid but the exanthema continued to worsen. Evaluation revealed posterior cervical lymphadenopathy, and a fungal culture was performed and grew *T tonsurans*. The patient was treated with griseofulvin ultramicrosize, which was discontinued after 2 weeks because of gastrointestinal distress and minimal improvement. Griseofulvin microsize liquid was administered orally for 2 weeks, but she continued to have gastrointestinal symptoms. She received a total of 4 weeks of treatment without improvement. She was subsequently treated with a double dose of terbinafine 125 mg daily (one-half tablet crushed to powder) for 6 weeks with complete resolution and hair regrowth. No adverse events were noted (**Table I**).

KOH Potassium hydroxide

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The authors declare no conflicts of interest.

http://dx.doi.org10.1016/j.jpeds.2016.12.042

Table I. Newly reported cases of tinea capitis

Cases	Age	Sex	Race	Pathogen	Treatment	Dosing	Duration	Side effects	Cure	Recurrence
Case 1	12 mo	F	White	*M canis*	Fluconazole	5 mg/kg/d	6 wk	None	Yes	No
Case 2	18 d	M	African American	*T tonsurans*	Fluconazole	5 mg/kg/d	6 wk	None	Yes	No
Case 3	14 d	M	White	*M canis*	Griseofulvin ultramicrosize	15 mg/kg/d	10 wk	none	Yes	No
Case 4	16 mo	F	African American	*T tonsurans*	Terbinafine	125 mg/d	6 wk	Gastrointestinal from griseofulvin, none with terbinafine	Yes	No

F, female; *M*, male.

Review of Literature Study Design

A search for all English studies (case reports, case series, prospective trials) of patients younger than 2 years of age diagnosed with tinea capitis and treated with oral agents was performed in the following databases: MEDLINE (PubMed), Cochrane Library (Wiley), Embase, and Web of Science (**Appendix**; available at www.jpeds.com). Titles and abstracts from initial search were reviewed. Inclusion criteria included patient age under 2 years, diagnosis of tinea capitis, and systemic treatment. Treatment with topical medications, children over 2 years of age, tinea corporis, and nondermatophyte infections were exclusion criteria. Remaining studies were reviewed in detail and studies without specific patient data were excluded. Data on demographics, microbiology, and treatment were extracted from included studies and were analyzed using descriptive statistics with means for continuous variables and frequencies and percentages for dichotomous variables.

Results

The initial search yielded 518 unique articles. Of these, 74 were included and reviewed in detail. In-depth review excluded 56 articles yielding 18 unique studies (**Table II** and **Figure 2**; **Figure 2** available at www.jpeds.com).

There were 168 cases of tinea capitis in infants from 0-2 years of age. The majority was reported by Al-Fouzan and was part of a larger cohort of children. Of this cohort, 121 patients were children ages 0-12 months, but specific patient data were not included. In this group of primarily middle eastern children, *M canis* was the most common dermatophyte, followed by *T violaceum*. The 121 patients 0-2 years of age with tinea capitis were treated with griseofulvin for 4-10 weeks. A subset was treated with a combination of oral and topical agents and showed improved therapeutic results at 4-6 weeks but showed no difference compared with oral therapy alone by 8-10 weeks. Specific details on younger patients were not given.[20,27]

There were 47 cases from the literature with specific patient data, to which we add 4. The average age was 22.7 weeks (2-68 weeks) with a male predominance (3:2, male:female). Racial data was poorly reported (n = 27) and of these 13 patients were white (48%), 10 black/African (33%), 3 Latino (11%), and 2 Asian (7%). Sources of infection varied from a household pet to an affected family member.[1,11,15,16,18]

M canis was the most common pathogen (52%), followed by *T mentagrophytes* (15%). One patient was infected with 2 different organisms (*T rubrum* and *T mentagrophytes*)[24] (**Figure 3**, A). Most patients were treated with griseofulvin (67%) (data for microsize/ultramicrosize were not reported reliably); 19% of children were treated with itraconazole, 9% with terbinafine, and 4% with fluconazole (**Figure 3**, B). All patients reportedly were cured without any side effects. Two patients initially treated with griseofulvin were retreated with terbinafine. One was treated with griseofulvin 10 mg/kg/day and subsequently treated with terbinafine 62.5 mg daily with complete cure.[26] We report 1 patient who did not tolerate griseofulvin and was then treated with terbinafine. Dosing regimens for griseofulvin varied between 10 and 20 mg/kg/day. Romano et al[16] used a standard 125 mg/day for patients treated with griseofulvin. Itraconazole was used in doses of 5 mg/kg/day. In 2 reports, itraconazole was used in pulsed dosing.[13,22] Terbinafine was used in doses of 62.5 mg or 125 mg daily. Fluconazole was used in doses of 5 or 6 mg/kg/day. Treatment duration averaged 5.5 weeks.

Cost is variable for these agents. Terbinafine tablets are the cheapest option as it has been added to many insurance plans. Fluconazole ranges from $10 to $55 depending on the formulation. Griseofulvin micro solution and tablets cost about $42 and $102, respectively, and griseofulvin ultramicrosize averages about $0.93/mg. Itraconazole is the most expensive at $310 for solution and $147 for tablets (**Table III**).[28]

Discussion

Clinical Presentation

Tinea capitis in children under 2 years of age likely is more common than is reported. Although the incidence is low, tinea capitis should be suspected or the differential diagnosis be included in an infant with a clinical presentation of alopecia, hair thinning, itching, and/or flaking that is persistent or does not respond to antibiotic or other non-antifungal therapy. These lesions can be inflammatory and heal with scarring. The differential diagnosis may include neonatal lupus, Langerhans cell histiocytosis, syphilis, seborrheic dermatitis, and atopic dermatitis. The cause and clinical presentation of tinea capitis in infants is similar to older children, with most cases associated with *T tonsurans* and noninflammatory scaly patches with or without hair loss, much like seborrheic dermatitis in older children.[19] Tinea capitis in infants caused by *M canis* is much less common and also manifests similarly to older children, with inflammatory annular scaly plaques and/or pustules.