A Review of Tinea Capitis in a Cohort of Asian Children

Dear Editor,

Tinea capitis most commonly affects children but rarely, adults.[1-2] *Trichophyton* and *Microsporum* species are the commonest dermatophyte species implicated. Non-inflammatory variants of tinea capitis are more common than inflammatory variants, such as kerion and favus. However, inflammatory variants can lead to scarring alopecia, necessitating early and accurate diagnosis and treatment. Optimal treatment of tinea capitis requires the use of prolonged courses of oral antifungal agents as topical monotherapy is usually inadequate. We performed a retrospective analysis of tinea capitis in our institution, aiming to provide data on disease presentation, natural history, treatment and outcomes.

Materials and Methods

Our study involved children aged 16 years and younger with tinea capitis—confirmed on fungal culture, identified over an 11-year period (2005-2016) at Dermatology Service, KK Women's & Children's Hospital, Singapore. Ethics approval was obtained from the Institutional Review Board. Cases were identified through records obtained from the hospital's microbiology laboratory. For patients who did not return for review after treatment, an attempt was made to contact their caregivers by phone, inquiring on the outcome post-treatment.

Results

Seventeen patients (13 females and 4 males) were identified (Table 1). The mean age at initial presentation was 4 years (range: 1 month-8 years). There were a disproportionate number of Malays (10 patients) compared to other races (Chinese and Indians). Mean duration of symptoms before presentation was 6.7 weeks (range: 1-16 weeks). Ten patients (59%) had a history of contact with animals, especially cats (9 patients). Three patients had contact with other family members with tinea.

Eight patients (47%) presented with scaly patches, 3 patients (18%) with erythematous plaques, 3 patients (18%) with erythematous nodules and 3 patients (18%) with papulovesicles. Itch was present in 9 cases (53%) and pain was reported in 7 (41%). There were 14 cases (82%) with alopecia, 5 (29%) with regional lymphadenopathy and 3 (18%) were febrile. Alopecia was non-scarring in all cases, except in 1 case of kerion.

Five cases (29%) were diagnosed clinically as kerion and 12 cases (71%) as non-inflammatory tinea capitis. Amongst the cases diagnosed as kerion, 4 cases had purulent or exudative discharge, 4 had associated alopecia (1 with scarring), 3 had lymphadenopathy and 2 were febrile. Histology was performed on 1 patient as the patient was initially admitted under the surgical service with suspicion of a deep scalp infection. The biopsy subsequently showed fungal spores coating the hair shaft (Fig. 1).

Fungal microscopy—performed on directly-pulled hair specimens—were positive for fungal hyphae in 7 cases (41%), blastoconidia in 1 case (6%) and negative in 9 cases (53%). Fungal cultures were positive for *Microporum* species in 10 cases (59%), *Trichophyton* species in 6 cases (35%), and *Epidermophyton floccosum* in 1 case. In cases of kerion, 2 were positive for *Trichophyton* species and 3 for *Microsporum* species. Seven cases (41%) had pyogenic cultures performed with 1 case (6%) positive for *Staphylococcus aureus*. This patient was concomitantly treated with oral antibiotics.

Fourteen patients (82%) were treated with oral antifungals, as selected by their treating dermatologist. Eight cases (47.1%) were treated with griseofulvin (20-25 mg/kg/day), 5 cases (29.4%) with terbinafine (20-40 kg: 125 mg, >40 kg: 250 mg) and 1 (5.9%) with itraconazole (5 mg/kg/day). All patients with *Microsporum* species were treated with either griseofulvin or terbinafine. Liver function tests were performed for 7 patients (before initiation therapy) and for 4 patients (within 1 month after initiating treatment). All results were normal.

Patients were treated for an average of 8.5 weeks. Those who received terbinafine had a shorter course of treatment (n = 5, 5.2 weeks) than those who received griseofulvin (n = 8, 10.8 weeks). Compared to terbinafine, those who received griseofulvin were treated for a longer duration before mycological clearance was achieved (11.3 weeks vs 4 weeks), though clinical improvement was achieved at around the same time (5.6 weeks vs 5.2 weeks).

All patients were concomitantly treated with topical antifungals (ketoconazole shampoo and clotrimazole cream). Three patients were treated with only topicals. They were younger (1, 5 and 15 months old) with less extensive disease. Two had significant improvement even before final fungal cultures returned, with average duration of treatment

Table 1. Patient Characteristics, Mycological Data and Treatment History

Patient No.	Age at Diagnosis	Race	Gender	Contact History with Animals	Clinical Diagnosis	Fungal Microscopy	Fungal Culture	Treatment	Duration (Weeks)	Outcome
1	8 years	Chinese	M	-	Kerion	-	*T. mentagrophytes*	Griseofulvin	10	Defaulted
2	5 months	Malay	F	+	Tinea capitis	-	*E. floccosum*	Topicals	12	Resolved
3	6 years	Chinese	F	+	Tinea capitis	+	*M. species*	Griseofulvin	16	Resolved
4	6 years	Others	F	-	Kerion	-	*T. rubrum*	Itraconazole	8	Defaulted
5	7 years	Chinese	M	+	Tinea capitis	Blastoconidia	*M. canis*	Terbinafine	6	Resolved
6	6 months	Malay	M	+	Tinea capitis	-	*M. species*	Griseofulvin	12	Resolved
7	6 years	Malay	M	+	Tinea capitis	+	*M. species*	Terbinafine	4	Resolved
8	3 years	Chinese	F	-	Tinea capitis	+	*M. species*	Terbinafine	8	Resolved
9	9 years	Malay	F	+	Tinea capitis	+	*M. species*	Terbinafine	4	Resolved
10	6 years	Malay	F	-	Kerion	-	*M. canis*	Griseofulvin	12	Resolved
11	2 years	Indian	F	-	Tinea capitis	-	*T. species*	Griseofulvin	8	Resolved
12	6 years	Malay	F	+	Tinea capitis	+	*T. tonsurans*	Terbinafine	4	Defaulted
13	1 month	Malay	F	-	Tinea capitis	+	*M. species*	Topicals	7	Defaulted
14	4 years	Chinese	F	-	Tinea capitis	+	*T. species*	Griseofulvin	10	Resolved
15	5 years	Malay	F	+	Kerion	-	*M. species*	Griseofulvin	10	Resolved
16	4 years	Malay	F	+	Kerion	-	*M. canis*	Griseofulvin	8	Defaulted
17	15 months	Malay	F	+	Tinea capitis	-	*T. rubrum*	Topicals	5	Defaulted

F: Female; M: Male

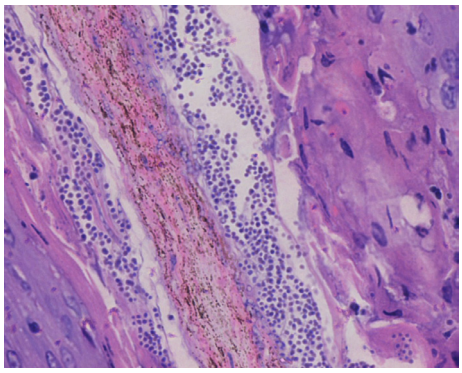

Fig. 1. Haematoxylin and eosin stain 100x demonstrating fungal spores encasing the hair shaft.

until clinical improvement and mycological clearance of 5.3 weeks and 8.7 weeks, respectively. The third patient did not attend follow-up.

Discussion

Tinea capitis is more common in children than adults. Reported incidence is highest amongst male school-going children aged 3-7 years.[2] In contrast, our study had a much higher female-to-male ratio of around 3:1. It is known that tinea capitis is more common in children of African descent compared to Hispanics and Caucasians. No clear cause for this racial predilection has been established.[3] Our study showed a higher incidence among Malays, especially if in contact with cats, a known predisposing factor.

Anthropophilic *Trichophyton* species are the most common species causing tinea capitis in the United States (*T. tonsurans*), Western Europe (*T. tonsurans, T. violaceum*) and Africa (*T. violaceum, T. soudanense*). In contrast, zoophilic *Microsporum* species was the most common in our series. This may explain the high incidence of inflammatory tinea capitis, with almost 30% (5 of 17 cases) presenting as kerion. Inflammatory tinea capitis is less common than non-inflammatory variants, with reported incidence of inflammatory tinea capitis ranging from 1.8 to 32%.[4-7] Inflammatory variants can mimic other conditions (e.g. bacterial furunculosis or deep abscesses) and are often inaccurately diagnosed leading to delayed treatment or unnecessary surgical intervention, with resultant scarring alopecia.[1,2,8,9]

Tinea capitis can be diagnosed with a high index of clinical suspicion. In a child presenting with alopecia associated with scaling, erythema or pustules—particularly with history of contact with animals—tinea capitis should always be excluded. A Wood's lamp examination demonstrates bright green florescence with *Microsporum* species. However, a negative examination does not exclude tinea capitis.

Microbiological cultures are important as results can influence the choice of therapy. Specimens can be obtained for microscopy by using a blunt scalpel if there is scalp scaling, and by plucking hair from the periphery.[8] Given the low sensitivity, relying on microscopy alone is insufficient and fungal cultures should be performed in all suspected cases. Empirical systemic therapy should be started if clinical suspicion is high, especially in inflammatory tinea capitis.

Treatment of tinea capitis requires the use of systemic antifungal therapy, as topical penetration of hair follicles is poor. Tinea capitis caused by *Trichophyton* species responds better to terbinafine, whilst *Microsporum* species responds better to griseofulvin.[10] Griseofulvin was used for most of our patients. Although it is not standard practice, terbinafine was used in some cases as it has been shown to demonstrate comparable efficacy and to require shorter duration of therapy, possibly improving compliance.[8] Clearance rates and tolerability were also comparable with griseofulvin. British guidelines recommend using either griseofulvin for 6-8 weeks, or terbinafine for 2-4 weeks, and to consider switching to an alternative if no clinical improvement is seen after the recommended treatment duration.[8]

Reported side-effects of oral antifungals include diarrhoea, nausea, vomiting and elevated liver enzymes. These are mild and reversible. Severe adverse events are rare.[10] The risk of haematological or hepatocellular derangement is low and laboratory monitoring for griseofulvin is generally unnecessary.[11-12] For prolonged terbinafine administration beyond 4-6 weeks, baseline evaluation of liver function and full blood counts are recommended.[12-13]

Topical antifungal therapy is considered ineffective due to poor penetration of the hair follicle and should not be used as monotherapy. In our series, topical therapy was used in 3 patients due to concerns about safety of oral antifungals in infancy. All 3 patients were less than 2 years of age with milder disease and responded to topical therapy. This may be due to higher topical penetration into hair follicles in thinner infant scalp. Infants also have a higher percentage of telogen hairs and this may contribute to the higher efficacy of topical antifungals.[14-15] We propose that topical antifungal therapy may be considered for children less than 2 years of age with non-inflammatory tinea capitis, if there are any contraindications to systemic therapy.

As this was a retrospective study, treatment outcomes were not standardised. There were a substantial number of patients who did not return for review. We, however, attempted to assess these patient outcomes by phone interview.

Conclusion

In conclusion, we hope to highlight the importance of early diagnosis and treatment due to the high proportion of inflammatory variants of tinea capitis in our local population, which can lead to scarring alopecia. Oral terbinafine has a shorter duration of therapy and may be a suitable alternative in children who cannot tolerate griseofulvin. Finally, topical antifungals may be suitable for younger infants with non-inflammatory tinea capitis. However this should not be used as firstline treatment and should only be considered in those unable to tolerate or unwilling to start on oral antifungals.

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