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RECEIVED 19 September 2023

ACCEPTED 07 November 2023

PUBLISHED 17 November 2023

CITATION

Hwang JK, Gold JAW, Paller AS and Lipner SR (2023) Low utilization of confirmatory testing for tinea capitis by pediatricians at an academic center in New York, United States, 2005–2021. *Front. Pediatr.* 11:1297339. doi: 10.3389/fped.2023.1297339

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Low utilization of confirmatory testing for tinea capitis by pediatricians at an academic center in New York, United States, 2005–2021

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We retrospectively reviewed physician diagnostic and treatment practices for pediatric tinea capitis at an academic institution over 16 years, in assessing adherence with published guidelines. We demonstrate the need to increase utilization of confirmatory testing and systemic therapy, and call for directed pediatrician education towards these goals.

KEYWORDS

tinea, tinea capitis, fungal infections, diagnosis, treatment

Introduction

Tinea capitis (TC), a fungal scalp infection, is the most common childhood dermatophytosis worldwide (1). TC primarily affects children aged 3–14 years, particularly Black males, and is most often caused by *Microsporum* and *Trichophyton* species. In the United States, *T. tonsurans* is the most common causative species (2). American Academy of Dermatology guidelines (1996, most recent year) and the American Academy of Pediatrics Committee on Infectious Disease (2021 Red Book, most recent year) emphasize confirmatory testing of suspected TC and treatment with systemic antifungals (3, 4). Confirmatory testing is important given possibility of misdiagnosis, ineffectiveness of topicals against TC, and need for antifungal stewardship in an era of emerging antifungal-resistant dermatophytes (5). Because data on guideline adherence are lacking, we aimed to capture TC diagnostic and treatment practices.

Methods

After Weill Cornell Medicine Institutional Review Board approval (22-09025241), Weill Cornell Medicine EPIC database was queried for patients 0–18 years diagnosed with TC (International Classification of Diseases-9 code 110.0, International Classification of Diseases-10 code B35.0) 10/1/2005–9/30/2021. Demographics, diagnosing physician specialty, diagnostic test(s) performed, and treatment(s) prescribed were described. Chi-squared tests compared diagnostic and treatment practices for dermatologists vs. pediatricians ($\alpha < 0.05$).

TABLE 1 Diagnosing physician specialty and demographics of patients with tinea capitis diagnoses from 2005 to 2021.

Encounters with tinea capitis diagnostic code (n = 265)		
Physician specialty		
Dermatology	132	49.8%
Pediatrics	130	49.1%
Emergency medicine	3	1.1%
Patient demographics (n = 239)		
Age at first encounter (average), years		
<1	16	6.7%
1–4	119	49.8%
5–10	98	41.0%
11–17	6	2.5%
Gender		
Male	135	56.5%
Female	104	43.5%
Race		
Black	126	70.8%
White	46	25.8%
Asian	6	3.4%
Unknown	61	
Ethnicity		
Hispanic	50	25.9%
Not Hispanic	143	74.1%
Unknown	46	

Results

Overall, 265 total patient visits were included, comprising 239 patients, with average age 4.4 years, 56.5% male, and 70.8% Black (Table 1). Most were diagnosed by dermatologists (49.8%) or pediatricians (49.1%). Diagnostic testing was performed in 57.7% of encounters, most commonly fungal cultures (94.8%) and potassium hydroxide (KOH) preparation (54.9%) (Table 2). Testing was performed more often by dermatologists than pediatricians (96.2% vs. 20.0%, $p < 0.00001$), with testing practices by specialty relatively stable over the study period (Figure 1). Identified species included 77.1% *T. tonsurans*, 4.2% *T. rubrum*, and 2.1% *M. canis*. Systemic therapy was prescribed most often (92.6%), and more commonly by dermatologists than pediatricians (96.6% vs. 88.6%, $p = 0.02$). Common systemics were griseofulvin (86.7%) and terbinafine (16.0%), with terbinafine more often utilized by dermatologists (30.0%) than pediatricians (1.8%). Systemics besides griseofulvin were utilized more often 2014–2021 vs. 2005–2013 (24.4% vs. 11.2%, $p = 0.01$). Common topicals were ketoconazole (69.5%) and clotrimazole (20.7%), with clotrimazole only prescribed by pediatricians.

Discussion

In this 16-year retrospective review of TC patients at Weill Cornell Medicine, virtually all dermatologists, but only one-fifth

TABLE 2 Diagnostic and treatment practices for patients with tinea capitis diagnoses from 2005 to 2021.

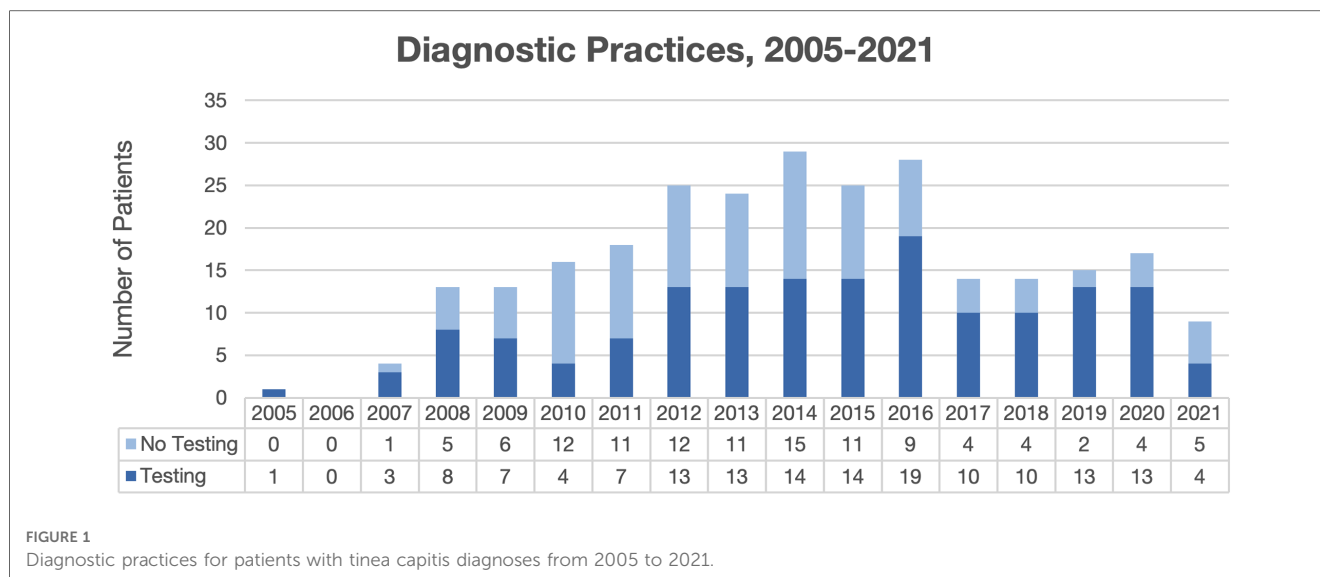
Diagnostic practices ^a	All (n = 265) ^c	Dermatology (n = 132)	Pediatrics (n = 130)	P-value [^]	
Testing performed	153 (57.7%)	127 (96.2%)	26 (20.0%)		
Fungal culture	145 (54.7%)	120 (90.9%)	25 (19.2%)		
Potassium hydroxide preparation	84 (31.7%)	84 (63.6%)	0		
Scalp biopsy	1 (0.4%)	1 (0.8%)	0		
Wood's lamp	1 (0.4%)	0	1 (0.8%)		
No testing performed	112 (42.3%) ^c	5 (3.8%)	104 (80.0%)		
Deemed not diagnostic after testing	22 (8.3%)	15 (11.3%)	7 (5.4%)		
Performed confirmatory testing	153 (57.7%)	127 (96.2%)	26 (20.0%)		$p < 0.00001$
No confirmatory testing performed	112 (42.3%) ^c	5 (3.8%)	104 (80.0%)		
Treatment practices ^b	All (n = 243) ^c	Dermatology (n = 117)	Pediatrics (n = 123)		
Systemic antifungals	225 (92.6%) ^c	113 (96.6%)	109 (88.6%)	$p = 0.02$	
Griseofulvin	195 (80.2%) ^c	85 (72.6%)	107 (87.0%)		
Terbinafine	36 (14.8%)	34 (29.1%)	2 (1.6%)		
Itraconazole	1 (0.4%)	1 (0.9%)	0		
Ketoconazole	1 (0.4%)	1 (0.9%)	0		
Fluconazole	1 (0.4%)	0	1 (0.8%)		
Topical antifungals	82 (33.7%)	47 (40.2%)	35 (28.5%)		
Ketoconazole	57 (23.5%)	39 (33.3%)	18 (14.6%)		
Clotrimazole	17 (7.0%)	0	17 (13.8%)		
Econazole	4 (1.6%)	3 (2.6%)	1 (0.8%)		
Terbinafine	2 (0.8%)	2 (1.7%)	0		
Miconazole	1 (0.4%)	0	1 (0.8%)		
Systemic corticosteroids	2 (0.8%)	1 (0.9%)	1 (0.8%)		
Topical corticosteroids	1 (0.4%)	0	1 (0.8%)		
Prescribed systemic and/or topical therapy	225 (92.6%) ^c	113 (96.6%)	109 (88.6%)		
Prescribed topical therapy only	18 (7.5%)	4 (3.4%)	14 (11.4%)		

^aNo encounters utilized polymerase chain reaction testing or antifungal susceptibility testing.

^bCases deemed not diagnostic after testing resulted are excluded from this section, as prescribed treatments were discontinued.

^cThree encounters in which patients were seen by emergency medicine physicians (all prescribed systemic griseofulvin only without confirmatory testing) were included in total count, but excluded from p -value calculations.

[^] P -values were calculated using chi-square tests comparing dermatologists vs. pediatricians.



of pediatricians, performed confirmatory testing. In a national commercial database study of 3.9 million pediatric TC encounters, confirmatory testing was infrequent (21.9%), with dermatologists testing more often than pediatricians (51.0% vs. 16.4%, $p < 0.01$), suggesting similar testing practices between academic and community pediatricians (6). KOH preparations were documented in approximately two-thirds of dermatologist encounters and in no pediatric encounters. Low testing rates by pediatricians may be due to lack of recognition of importance of diagnostic confirmation emphasized by American Academy of Dermatology guidelines and American Academy of Pediatrics Red Book recommendations, long fungal culture turnaround times competing with prompt treatment initiation, and lack of training or required Clinical Laboratory Improvement Amendments certification for KOH examinations (3, 4, 6).

Consistent with TC treatment guidelines, most patients were prescribed systemic antifungals (92.6%). Using topical antifungals (creams, shampoos) alone is discouraged, due to lack of hair follicle root penetration. However, 11.4% of pediatricians prescribed topical therapy only, similar to the aforementioned commercial database study reporting a 10.1% rate for pediatricians, emphasizing the need for directed education (6). For systemic therapies, a systematic review of 38 TC clinical trials reported overall 92% and 72% complete cure rates for terbinafine and griseofulvin, respectively, terbinafine being more effective for *Trichophyton* and griseofulvin more effective for *Microsporum* species (7). Terbinafine is regarded as first-line treatment in the US, given vast predominance of *Trichophyton* TC and shorter treatment course (6–8 weeks) (7). However, since terbinafine was infrequently prescribed by pediatricians (1.6%), directed education is necessary.

Limitations include single-center design and small sample size. However, our study may accurately reflect US practices, given congruence with the commercial database study (5).

We highlight opportunities to increase utilization of confirmatory testing and systemic therapy, and call for directed pediatrician education towards these goals.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by Institutional Review Board of BRANY, Institutional Review Board of Weill Cornell Medicine. The studies were conducted in accordance with the local legislation and institutional requirements. The ethics committee/institutional review board waived the requirement of written informed consent for participation from the participants or the participants' legal guardians/next of kin because retrospective review nature of study.

Author contributions

JH: Writing – original draft, Writing – review & editing. JG: Writing – review & editing. AP: Writing – review & editing. SL: Writing – review & editing.

Funding

The author(s) declare that no financial support was received for the research, authorship, and/or publication of this article.

Conflict of interest

AP is an investigator for AbbVie, Dermavant, Eli Lilly, Incyte, Janssen, Krystal, and UCB; a consultant for Aegerion Pharma, Azitra, BioCryst, Boehringer-Ingelheim, Bristol Myers Squibb, Castle Creek, Eli Lilly, Janssen, Krystal, LEO Pharma, Novartis, Regeneron, Sanofi/Genzyme, Seanergy, TWI Biotechnology, and

UCB; and on the Data and Safety Monitoring Board (DSMB) for AbbVie, Abeona, Catawba, Galderma, and InMed. SL is a consultant for Eli Lilly, Ortho-Dermatologics, Belle Torus Corporation, and Moberg Pharmaceuticals.

The remaining authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Author disclaimer

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

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