The Predictive Value of Symptoms in Diagnosing Childhood Tinea Capitis

Thomas W. Hubbard, MD, MPH

Objective: To determine which sign, symptom, or combination thereof best predicts cultures positive for fungi in children with possible tinea capitis.

Design: Convenience survey.

Setting: Urban hospital-based general pediatric practice.

Patients: Results were obtained on 100 consecutive children presenting with at least 1 sign or symptom (scalp pruritus, scaling, diffuse or circumscribed alopecia, or occipital adenopathy).

Intervention: All enrolled children had samples for scalp cultures taken. Demographic information and clinical findings were verified by the author.

Main Outcome Measure: Whether detected clinical findings can predict the outcome of fungal cultures.

Results: Cultures positive for fungi were found in 68 children. There was a significant relationship (Fisher exact test; \( P < 0.001 \)) between the number of signs and symptoms and a culture positive for fungi. Positive likelihood ratios were 7.5, 3.3, 1.4, and 1.1 for the presence of adenopathy, alopecia, pruritus, and scaling, respectively, for children with cultures positive for fungi. All children \((n = 55)\) who presented with both adenopathy and alopecia and 60 of 62 children who presented with both adenopathy and scaling had cultures positive for fungi. No cultures positive for fungi were found in children without adenopathy and scaling; only 1 of 68 children without adenopathy and alopecia had a culture positive for fungi.

Conclusions: In children who are suspected of having tinea capitis, there is a high likelihood of cultures positive for fungi in those with adenopathy. A fungal infection is rarely the cause when neither adenopathy nor alopecia is present. Attention to signs and symptoms in children with suspected tinea capitis can result in better diagnostic and treatment precision.


Editor's Note: This study provides some interesting information on the clinical diagnosis of tinea capitis. If the findings can be duplicated in a larger population, the need for a laboratory test might be scratched. I’m all for it.

Catherine D. DeAngelis, MD

Tinea Capitis is a common childhood dermatophytosis that presents diagnostic problems because of its nonspecific presentation and lack of a quick, reliable confirmatory test. Once suspected, the diagnosis may not be verified immediately in some care settings. Despite the uncertainty of diagnosis, antifungal treatment is often initiated to reduce symptoms, to allow a child’s reinstatement in the classroom, and to prevent the spread of the fungi. However, empiric treatment will result in a number of patients receiving unnecessary medications that are expensive and have potential adverse effects. Better means of identifying children who have a high probability of infection will decrease the need for confirmatory tests and will improve treatment.

Children infected with the predominant microorganism associated with tinea capitis, *Trichophyton tonsurans*, often present with nonspecific clinical findings. In the absence of certain characteristic findings, such as black-dot alopecia or kerion, a clinician may fail to suspect dermatophytosis. Infected children may have signs or symptoms that range from minimal scaling and scalp pruritus resembling seborrhea to a pustular presentation that may be confused with folliculitis. Even in instances of nonspecific findings, timely diagnosis and treatment is key to prevent the spread of *T tonsurans* to others and the de-
Subjects and Methods

Population

Children seen at the Children’s Outpatient Center of the Children’s Hospital of The King’s Daughters in Norfolk, Va, between March 1995 and September 1997, were eligible for enrollment. This study was a convenience sample of consecutive patients eligible for enrollment. Irrespective of the purpose of the visit, children were eligible when I was present to make an assessment. Parental informed consent was obtained according to guidelines of the institutional review board of the Eastern Virginia Medical School. One hundred consecutive children presenting with at least 1 of 4 designated signs or symptoms and undergoing a scalp culture were studied. The 4 signs or symptoms included scaling of the scalp; scalp pruritus; diffuse, patchy, or discrete alopecia; and adenopathy. Adenopathy was detected if palpable lymph nodes were present in the occipital or posterior auricular lymphatic chains. Children were excluded if they presented with kerion and pustular folliculitis, a known dermatologic condition such as psoriasis or eczema, or had been treated for tinea capitis within the previous year. Children with generalized lymphadenopathy were not enrolled. It was my practice to conduct a fungal culture for all children who had at least 1 of the 4 signs or symptoms. A symptom was defined as present based on the direct observation or history of scaling or pruritus and any degree of adenopathy as noted by me.

Laboratory Evaluation

Scalp debris was collected by the brush culture method and tested using Dermatophyte Test Media (Acuderm, Inc, Ft Lauderdale, Fla). All cultures were processed by the hospital’s mycology laboratory. The species of dermatophyte was identified for all cultures positive for fungi. Slant cultures without fungal growth at 28 days were discarded and reported as negative for fungi.

Statistical Analysis

The Fisher exact test was used for statistical analysis. Positive and negative likelihood ratios and positive and negative predictive values were calculated for each sign and symptom.

Results

Subjects

The enrollees included 47 boys and 53 girls whose ages ranged from 7 months to 11 years (median age, 4.0 years). All but 2 children were African American; at least 90% were members of the Children’s Outpatient Center’s Medicaid health maintenance organization panel, Norfolk. In the 100 enrolled children, scaling was the most common symptom, recorded in 93% of subjects; pruritus, alopecia, and adenopathy were found in 75%, 73%, and 65%, respectively.

Laboratory Findings

Sixty-eight percent of children had cultures positive for fungi (Table 1). This group consisted of 35 boys and 33 girls whose mean ± SD age was 4.5 ± 2.3 years. T. tonsurans was isolated in all cases. All cultures positive for T. tonsurans had been obtained from African American children. The mean age and range, sex distribution, racial predilection, and causative organism of the study children were similar to those in published reports.

Statistical Analysis

The chance of having a culture positive for fungi was significantly (P < .001) associated with the number of presenting signs or symptoms. All children (n = 43) who presented with all 4 signs and symptoms had cultures positive for T. tonsurans; 92% (n = 22) and 11% (n = 3) who presented with 3 or 2 signs or symptoms, respectively, were infected; none of the 6 children who presented with a single sign or symptom had a culture positive for fungi. Table 2 shows positive likelihood ratios, negative likelihood ratios, positive predictive values, and negative predictive values of individual signs and symptoms. The presence of adenopathy increased the likelihood ratio the most; its absence decreased the likelihood of cultures positive for fungi the most. It also had the highest positive predictive and negative predictive values.

All 55 children who presented with both adenopathy and alopecia (with or without pruritus or scaling) had cultures positive for T. tonsurans; when neither adenopathy nor alopecia was found, only 1 (6%) of 16 children had cultures positive for fungi. In the 62 children with adenopathy and scaling (with or without alopecia or pruritus), 2 had cultures negative for fungi; no child had a culture positive for fungi when both findings were absent (n = 4). In the 7 infected children who did not have adenopathy, the presence of both alopecia and scaling was identified in 6.

Comment

Tinea capitis is a common disease with increasing prevalence. This is owing partly to its ease of spread, including instances in which the diagnosis is not made because of nonspecific clinical presentation. Even when suspected, confirmation is problematic because some practitioners have no means to confirm it in a timely fashion. This study suggests that specific clinical findings can improve a practitioner’s ability to diagnose fungal disease.

There are 2 accepted methods for confirming tinea capitis: microscopic analysis of scalp debris and fungal culture. Microscopic visualization of infected hair shafts...
is the only method that immediately confirms infection. However, it is a time-consuming procedure that requires an experienced observer and equipment that is not available in every practitioner’s office. Although the specificity of this test is high, the rate of false-negative interpretations may exceed 40% even for experienced observers.10,12 False interpretations often result when the sample is obtained incorrectly or findings are misinterpreted as artifact.13 Newly described procedures to increase the yield of this test, such as the use of calcofluor white stain, are available only through hospital laboratories.13

Obtaining culture samples from the scalp for dermatophytes is a quick, simple, and painless process. A sample can be obtained from the scalp using a toothbrush2 or cotton swab14 and is directly plated on agar. The requirement that cultures must be processed by a certified laboratory increases the inconvenience and costs. The primary disadvantage of basing treatment plans on culture results is the 1- to 3-week delay for results. Delaying treatment may allow further contagion to others and prolong a child’s absence from school. Conversely, beginning treatment before receiving culture results leads to unnecessary, expensive treatment in some children.

The typical inflammatory presentation of tinea capitis is characterized by erythema, folliculitis and pustules, and adenopathy.1,13,16 Adenopathy is not mentioned specifically as a symptom in the more prevalent noninflammatory type with alopecia and scaling. In this study, 61 children (90%) with cultures positive for fungi had adenopathy compared with previous reports that ranged from 42% to 72%.5,17 The disparity may be owing to my recording of any degree of adenopathy in the posterior cervical and occipital chains. Also, studies that reported adenopathy did not differentiate between inflammatory or noninflammatory presentations of tinea capitis. Since no children with the typical presentation of inflammatory disease were enrolled, these findings indicate noninflammatory tinea capitis. In this study, only 4 children (13%) with cultures negative for fungi had adenopathy. Detecting posterior auricular or occipital adenopathy increased the likelihood of a culture positive for fungi in the noninflammatory form of tinea capitis, while its absence suggests an origin other than fungal.

Alopecia occurred in 61 children (90%) with cultures positive for T tonsurans. This rate is similar to the published range of 80% to 100%.10,17 Approximately one third of children with cultures negative for fungi presented with alopecia. Its absence is a less reliable predictor of cultures negative for fungi than adenopathy. Scaling was more common in this study than the rate of 65% in another study.9 There was no reference to the rate of pruritus in other studies.

Diagnostic precision can be enhanced when combinations of signs or symptoms are detected. Previous studies have not reported results in this manner. Based on this study, children who present with all 4 signs and symptoms invariably will have cultures positive for fungi. Children who present with fewer than 4 findings but who have adenopathy also will have a high probability of tinea capitis. No child lacking both adenopathy and scaling had a culture positive for fungi. There was a rate of only 6% for cultures positive for fungi in children who present with neither adenopathy nor alopecia.

The prevalence of carrier state was not studied since eligibility for enrollment was restricted to symptomatic children. Since the rate of asymptomatic colonization by fungus in comparable populations is up to 15%,18-20 some subjects may have had cultures positive for fungi when their symptoms were, in fact, not caused by T tonsurans. Other disease entities that are less common than tinea capitis yet cause a similar clinical picture may not have been represented in such a small study population. Only larger studies would detect the association between particular findings and other dermatologic conditions. Also, since our patient population was largely African American, a larger study with other races may be needed to confirm the general applicability of these results.

Applying the findings of this study to a comparable practice means timely diagnoses and cost savings in about two thirds of children with suspected tinea capitis. Through identification of children with a high probability of infection, confirmatory testing can be omitted, particularly in situations in which appropriate equipment or expertise is lacking. Besides the resulting savings in time and expense, treatment can be initiated immediately, thereby relieving symptoms and reducing the period of contagion. More than half of the children presenting with symptoms in this study could have been treated in this manner. Furthermore, testing might have been omitted in another 15% or so of children lacking certain clinical findings.

In summary, children with suspected tinea capitis presenting with adenopathy, particularly accompanied by alopecia or scaling, have a high probability of disease. When reliable immediate laboratory confirmation

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**Table 1. Characteristics of Enrolled Children**

<table>
<thead>
<tr>
<th>Demographics</th>
<th>Positive (n = 68)</th>
<th>Negative (n = 32)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean ± SD age, y</td>
<td>4.5 ± 2.3</td>
<td>4.3 ± 2.1</td>
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<tr>
<td>Male-female ratio</td>
<td>35:33</td>
<td>12:20</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Clinical findings</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scaling</td>
<td>97</td>
</tr>
<tr>
<td>Adenopathy</td>
<td>90</td>
</tr>
<tr>
<td>Alopecia</td>
<td>90</td>
</tr>
<tr>
<td>Pruritus</td>
<td>81</td>
</tr>
</tbody>
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**Table 2. Performance Characteristics of Signs and Symptoms of Tinea Capitis and Culture Results**

<table>
<thead>
<tr>
<th>Sign or Symptom</th>
<th>PLR</th>
<th>NLR</th>
<th>PPV, %</th>
<th>NPV, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adenopathy (n = 65)</td>
<td>7.5</td>
<td>0.11</td>
<td>94</td>
<td>80</td>
</tr>
<tr>
<td>Alopecia (n = 73)</td>
<td>3.3</td>
<td>0.16</td>
<td>84</td>
<td>74</td>
</tr>
<tr>
<td>Pruritus (n = 75)</td>
<td>1.4</td>
<td>0.43</td>
<td>75</td>
<td>52</td>
</tr>
<tr>
<td>Scaling (n = 93)</td>
<td>1.1</td>
<td>0.19</td>
<td>71</td>
<td>71</td>
</tr>
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* All values are given as percentages except where noted otherwise.
is unavailable, practitioners should initiate treatment based on clinical findings.

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REFERENCES