Asymptomatic Dermatophyte Carriers in the Households of Children With Tinea Capitis

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Objectives: To determine the prevalence of the carrier state in household contacts in children with tinea capitis, the duration of the carrier state, factors associated with carriage, and the proportion of carriers who develop clinical disease.

Design: Cross-sectional, cohort, prevalence study.

Setting: General pediatric clinic serving an indigent, inner-city, African American population.

Patients: Household contacts in children with tinea capitis. Index cases and carriers (no clinical evidence of infection) were identified by culture. Carriers were monitored until the results of their culture became negative, they developed clinical disease, or a 6-month period had elapsed.

Results: Fifty-six index cases and 114 contacts (50 adults and 64 children) were evaluated. Ninety-eight percent of the dermatophytes identified in index cases and 100% in carriers were *Trichophyton tonsurans*. At the initial visit, 18 (16%) of 114 (95% confidence interval [95% CI], 10-24) of contacts were carriers and 14 (32%) of 44 of the families studied had at least 1 carrier. At the 2-, 4-, and 6-month visits, the carrier state persisted in 7 (41%) of 17 (95% CI, 19-67), 3 (20%) of 15 (95% CI, 4-48), and 2 (13%) of 15 (95% CI, 2-40), respectively. Three of the carriers were lost to follow-up. Of the carriers, 1 (7%) of 15 (95% CI, 0.2-32) developed tinea capitis. Univariate and multivariate analysis showed no association of carrier state to age, sex, comb sharing, or cosleeping. However, cosleeping and comb sharing were common among the contacts, occurring 75% and 78% of the time, respectively, making statistical correlation difficult with our sample size.

Conclusions: Initial prevalence of asymptomatic carriage of dermatophytes among household contacts of a child with tinea capitis was 16%, with 41% of carriers persisting up to 2 months. Thirty-two percent of the carriers developed an active infection. Treatment of carriers with sporicidal shampoo should be considered since they may act as a reservoir for infection or develop active disease. The high prevalence of cosleeping and comb sharing may be important factors in the spread of the disease.

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**TINEA CAPITIS** is a very common superficial fungal infection, particularly among inner-city African Americans. It is caused primarily by the dermatophyte *Trichophyton tonsurans*. In 2 epidemiologic surveys, it accounted for 7% of all patient visits involving a skin lesion at an academic general pediatric clinic and represented 7.1% of all referrals to a university pediatric dermatology clinic. In a study involving children who received Medi-Cal benefits, from 1984 to 1993 there was an increase of 209.7% for African American and 140.4% for white children in the number of prescriptions written for griseofulvin suspension, which was used as a marker for cases of tinea capitis. The treatment of the disease can be costly and prolonged, requiring at least 6 weeks of an oral antifungal drug, usually griseofulvin. To better control the spread of this disease, we need to know more about its epidemiology.

The goals of this study were to determine the prevalence of carriers in households of children with tinea capitis, the duration of the carrier state, factors associated with carriage, and the proportion of carriers who develop active infection.

**RESULTS**

Sixty-five index cases and 140 contacts were initially enrolled in the study. Nine index cases were eliminated because of
negative cultures, leaving 56 index cases and 114 contacts (50 adults and 64 children) for evaluation. Ninety-four percent of the adult contacts were women. The population was almost entirely African American (96%) and the median ages of the child and adult contacts were 5.4 and 26.3 years, respectively. The median age of the child contact was 5.4 years, and the median age of the adult contact was 26.3 years. The median ages of the child and adult contacts were 5.4 and 26.3 years, respectively. The median ages of the child and adult contacts were 5.4 and 26.3 years, respectively. The median ages of the child and adult contacts were 5.4 and 26.3 years, respectively.

At the initial visit, 18 (16%) of 114 (95% CI, 10-24) of contacts were carriers, of which 6 (33%) of 18 were adults. Of the households studied, 14 (32%) of 44 had at least 1 carrier. At the 2-, 4-, and 6-month visits, the carrier state persisted in 7 (41%) of 17 (95% CI, 19-67), 3 (20%) of 15 (95% CI, 4-48), and 2 (13%) of 15 (95% CI, 2-40), respectively (Figure). The 1 carrier (7%; 95% CI, 0.2%-32%) that developed clinical disease did so by the 2-month visit. A total of 3 carriers were lost to follow-up.

Patients and Methods

Study Design and Population

A cross-sectional prevalence study was performed involving patients from a general pediatric clinic serving mainly an indigent, inner-city, African American population. Eligible enrollees included all children and adults present at the time of the initial clinic visit who resided in the same household as a child with clinical tinea capitis (index case) and would presumably continue to live there for at least 6 months. Not all household members were able to be enrolled. To be included in the study, contacts had to have clinically obvious signs of tinea capitis (substantial scaling, alopecia, or signs of inflammation) and results of cultures from the index cases needed to be positive by at least 1 of 2 methods. Contacts were excluded from the study if a sporacidal shampoo had been used.

Specimen Collection and Culture

Samples of scalp and hair were obtained from both index cases and contacts by briskly rubbing the scalp with a disposable toothbrush. Samples were collected from the areas of obvious infection from the index case and from multiple areas of the scalp from contacts. Although the skin of contacts was not routinely examined, the parent and child were questioned about the presence of any other skin lesions. For the index cases, all specimens were inoculated onto Mycosel agar (Mycosel agar; Becton Dickinson Microbiology Systems, Cockeysville, Md) and Dermatophyte Test Media (Dermatophyte Test Media; Remel, Lenexa, Kan), except for 2 that were cultured only on test media. All samples from contacts were inoculated on Mycosel agar only. Dermatophyte identification was determined by colony morphology and wet mounts for all positive contacts. For index cases, culture was considered positive if there was a red color change on the Dermatophyte Test Media within 10 to 14 days (indicative of pathogenic dermatophytes) and if the morphology was consistent with a dermatophyte or by colony morphology on Mycosel agar. All positive Mycosel cultures were examined microscopically for species identification.

Patient Evaluation

At the time of enrollment, the adult caretaker filled out a survey soliciting epidemiological information regarding risk factors (predictor variables) for development of the carrier state. Data obtained included demographic variables; age, sex, and race; comb sharing; cosleeping among family members or with the index case; and dermatophyte infection in household members during the past 3 months. To compare the frequency of cosleeping among households with a subject who had tinea capitis to those without, 56 families with the same racial makeup who came to the clinic for a condition other than ringworm were questioned as to the presence of cosleeping. To be included, the household had to consist of 2 or more children, with at least 1 between the ages of 2 months and 10 years.

Household contacts who were culture positive were recultured and examined every 2 months for 6 months or until they became culture negative, when they were discharged from the study. They were considered to have developed active disease if any of the following signs were present: diffuse or localized scale, alopecia, or inflammatory lesions of the scalp. These patients were treated and discharged from the study.

Statistical Analysis

A commercial software program (Epi-info; Center for Disease Control, Atlanta, Ga) was used to evaluate the predictor variables for the carrier state and for 95% confidence limits on prevalence date. Multiple logistic regression was performed using another commercial software program (SAS version 6.12; SAS Institute Inc, Cary, NC).

Comment

Tinea capitis has become increasingly common, particularly in inner cities, and represents a substantial health problem and financial burden. Although little information is available on how often asymptomatic carriers are...
associated with the spread of disease or whether they subsequently develop active infection, they may be an important epidemiologic factor. Several studies have documented recovery of dermatophytes from the scalps of asymptomatic contacts, however, in several of these studies carriers were not followed up prospectively. Furthermore, the dermatophytes involved were not always *T. tonsurans*, the most common causative agent in the United States today.  

We found that at least 1 carrier was present in 32% of households that had a child with tinea capitis. Our carrier rate of 16% among household contacts, although on the low side, was within the range of other published studies. However, unlike most other published studies identifying asymptomatic carriers, we determined prospectively that 41% of these contacts remained culture positive for at least 2 months.  

Williams et al  

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Williams et al recently looked at the prevalence of asymptomatic carriers (predominantly *T. tonsurans*) in a small inner-city school. They found that 58% of their untreated carriers remained culture positive for a mean of 2.3 months, a figure similar to our findings. However, these children were not recultured at regular intervals. They could find no relationship between the development of the carrier state in classrooms that had a clinical case of tinea capitis compared with those that did not. In another recent study, Hay et al investigated the carrier state and undiagnosed tinea capitis in children attending several schools in London. The dermatophytes cultured were mainly *T. tonsurans* and *Microsporum audouini*. In contrast to the study by Williams et al, Hay et al found a correlation between the presence of 2 or more carriers and clinical infection in their classmates. The duration of the carrier state and the rate at which symptomatic disease developed was not investigated. In a report from Ethiopia, Babel and Baughman found that asymptomatic carriage of dermatophytes is high and prolonged in families where a case of tinea capitis exists, we recommend treating household members with a sporicidal shampoo in hopes of decreasing the chance of infection and the rate of acquisition of clinical disease. Although we could not show a statistical association between cosleeping and comb sharing with the carrier state, they may be important factors. The lack of statistical significance may be a result of their high prevalence in our study population, as a much larger study population would be required to show an effect. We were unable to present meaningful data on the risk of asymptomatic carriers developing tinea capitis because of the small number of carriers studied. One (7%) of 15 of carriers developed disease, but the confidence intervals were very wide. Further research is needed to determine the role of the asymptomatic carrier in the development of disease and the effect of cosleeping.

**Prevalence of Sharing a Bed or Sharing a Comb**

<table>
<thead>
<tr>
<th>Carriers, %</th>
<th>Noncarriers, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sharing a bed</td>
<td>78</td>
</tr>
<tr>
<td>Sharing a comb</td>
<td>83</td>
</tr>
</tbody>
</table>

*P = .53, †P = .41.

Their carriers had repeat cultures at 6 weeks or at 6 months only. In an older study, the carrier state and its progression to clinical disease was investigated in a group of Nigerian children; however, the dermatophyte involved was *Microsporum audouini*. Nineteen (25%) of 77 asymptomatic children were culture positive and 8 (42%) of these carried the organism for 4 months. However, that carriage rate was based on 1 follow-up culture at 4 months. Three (20%) developed symptomatic disease.

Although the importance of the carrier state in the development or spread of disease has not been adequately determined, its eradication seems a logical step in controlling the spread of tinea capitis. Considering that asymptomatic carriage of dermatophytes is high and prolonged in families where a case of tinea capitis exists, we recommend treating household members with a sporicidal shampoo in hopes of decreasing the chance of infection and the rate of acquisition of clinical disease. Although we could not show a statistical association between cosleeping and comb sharing with the carrier state, they may be important factors. The lack of statistical significance may be a result of their high prevalence in our study population, as a much larger study population would be required to show an effect. We were unable to present meaningful data on the risk of asymptomatic carriers developing tinea capitis because of the small number of carriers studied. One (7%) of 15 of carriers developed disease, but the confidence intervals were very wide. Further research is needed to determine the role of the asymptomatic carrier in the development of disease and the effect of cosleeping.

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REFERENCES


Announcement

Free Patient Record Forms Available
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