Onychomycosis in Icelandic children

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Abstract

Background Onychomycosis is a rare disorder in children. Few studies exist on the incidence or prevalence of onychomycosis in children.

Objective To examine the epidemiology of childhood onychomycosis in Iceland during the period 1982–2000.

Methods Results from all mycological samples taken from children in Iceland from 1982 to 2000 were examined. Information about the requesting physician, unique social security number, date of birth, sex, results of culture and microscopy were registered. Growth of a dermatophyte was taken as an indication of a case of onychomycosis.

Results During the period 1982–2000 a total of 493 samples from 408 Icelandic children, aged 0–17 years, were examined. Dermatophytes were cultured from 148 (30.0%) samples. During the period 1982–85, the mean annual incidence of positive cultures was 1.65 per 100 000, increasing to 21.30 per 100 000 for the years 1996–2000. Trichophyton rubrum was the dominating organism and was found in 102/148 cases positive for the growth of a dermatophyte. The incidence of positive dermatophyte cultures increased with age and was found in eight children aged 0–4, and in 57 children aged 10–14 years.

Conclusion Onychomycosis is rare in children, but increases with age. It seems that onychomycosis increased during the study period, but it is not clear if this was due to a true increase in the prevalence of onychomycosis or an increased awareness of onychomycosis, or both.

Introduction

Onychomycosis is a common disorder and is considered to be the most frequent nail disorder. The prevalence in Europe ranges from 2% to 8% depending on the country and methodology.1–5 It is generally accepted that onychomycosis is rare in children, but few studies have examined this issue.6–11 Although several case reports exist in the literature,12–14 In a study in 1997, Gupta et al. found a prevalence of 0.44% in children.9 The same study summarized studies around the world and found a prevalence of 0.35%. In the current study data from all children cultured in Iceland during the period 1982–2000 are presented.

Patients and methods

The mycological laboratory at Landspitali University Hospital was established late in the year 1982. It is the only mycological laboratory in Iceland and therefore processes all samples taken in Iceland. Name, unique personal identification number (includes date of birth), date of sampling, name of physician who requested the sample, results of microscopy and culture are registered for each sample processed. Until the year 1998, nail scrapings were examined with the use of 5% potassium hydroxide solution. After 1998, ‘chlorazol black E’ and dimethylsulfoxide were added. The specimens were also inoculated on Sabouraud’s dextrose agar containing chloramphenicol 0.05 g/L and on Mycobiotic agar. The cultures were incubated at 30 °C and examined weekly. The identification of dermatophytes and moulds was based on macroscopic and microscopic characteristics and on further examination with the use of potato dextrose agar, thiamine-enriched medium and urease test when appropriate. The identification of yeasts was based on germ tube tests and the API®20 AUX system (BioMérieux).
Dermatophytes when isolated were regarded as pathogens and a case of onychomycosis was defined when a positive culture was found for a dermatophyte. Microscopy alone was not sufficient. Yeasts can cause onychomycosis, but need to be correlated to the clinical findings and preferably serial positive cultures must exist. Although moulds can also cause onychomycosis, they are generally considered to be harmless commensals. Because of the nature of the study, serial cultures from the same patients could not be obtained. Therefore, in this study, no cases of onychomycosis could be ascertained to be caused by moulds or yeasts. Non-dermatophytes are therefore only included in the results for the purpose of organism distribution.

The National Register of Persons is a register of all those who have been domiciled in Iceland since 1952. The Register includes a unique ID number, name, domicile, sex, date of birth and other demographic factors.15 Data from the Register were used in calculations of the incidence and ratio of children diagnosed with onychomycosis during the study period.

Data regarding all children aged 0–17 years were entered into a database (Microsoft Access). Statistical analysis was performed with the Epi-info statistical package.

The study was approved by the Icelandic National Bioethics Committee.

**Results**

During the period 1982–2000 a total of 9029 nail keratin samples were taken in Iceland. Of these samples, 493 (5.5%) came from 408 children, aged 0–17 years.

Dermatophytes were cultured from 148 (30.0%) samples. Two hundred and seventy-one samples came from girls (55%), 219 (44.4%) from boys, and in three cases the sex was unknown. In the girls, 65 (24%) cases were positive for a growth of a dermatophyte, but in the boys the corresponding number was 82 (37.4%). One positive sample was found when the sex was unknown. Results from microscopy were not available for 11 samples, but positive microscopy was found from 34 (7.0%) samples that were negative for the growth of a dermatophyte (Table 1). The number of cases increased with age (Table 2). In the youngest age group, four patients were 3 years of age, three were 4 years and the youngest patient was 4 months with a *Trichophyton rubrum* infection of the toenails. *T. rubrum* was the dominating organism isolated, followed by yeasts and *T. mentagrophytes* (Table 3). Unfortunately, information about site (fingernails vs. toenails) was only available in less than half of the cases. Only 20 cases of fingernail samples are listed and of these, only two were positive for the growth of a dermatophyte. One hundred and seventy-two samples were from toenails and produced 66 positive samples (38.4%). The rest of the sample request forms did not include information on the site of the sample.

The number of positive samples in children increased during the study period (fig. 1). Based on the number of children living in Iceland, the annual incidence of positive cultures could be determined. During the years 1982–85 the mean annual incidence was 1.65 per 100 000 children, 4.48 for 1986–90, 11.07 for 1991–95 and 21.30 for 1996–2000. Thus the annual incidence was 13 times higher at the end of the study period than at the beginning of the period.

### Table 1  Mycological results from 482 samples in Iceland in 1982–2000, where information was available regarding both culture and microscopy. Results of microscopy were unavailable from 11 samples and thus a total of 493 samples existed. Positive culture indicates growth of a dermatophyte

<table>
<thead>
<tr>
<th>Culture positive (%)</th>
<th>Culture negative (%)</th>
<th>Total (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microscopy positive</td>
<td>91 (18.9)</td>
<td>34 (7.7)</td>
</tr>
<tr>
<td>Microscopy negative</td>
<td>51 (10.6)</td>
<td>306 (63.5)</td>
</tr>
<tr>
<td>Total</td>
<td>142 (29.5)</td>
<td>340 (70.5)</td>
</tr>
</tbody>
</table>

### Table 2  Number of cases positive for the growth of a dermatophyte according to age

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Number of samples</th>
<th>Number of samples positive for the growth of a dermatophyte</th>
<th>% of samples positive</th>
</tr>
</thead>
<tbody>
<tr>
<td>0–4</td>
<td>81</td>
<td>8</td>
<td>9.9</td>
</tr>
<tr>
<td>5–9</td>
<td>121</td>
<td>42</td>
<td>34.7</td>
</tr>
<tr>
<td>10–14</td>
<td>162</td>
<td>57</td>
<td>35.2</td>
</tr>
<tr>
<td>15–17</td>
<td>129</td>
<td>41</td>
<td>31.8</td>
</tr>
</tbody>
</table>

### Table 3  Fungi isolated from 493 samples

<table>
<thead>
<tr>
<th>Results of culture</th>
<th>No. of samples</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative</td>
<td>307</td>
<td>62.3</td>
</tr>
<tr>
<td><em>Trichophyton rubrum</em></td>
<td>102</td>
<td>20.7</td>
</tr>
<tr>
<td>Yeasts</td>
<td>31</td>
<td>6.3</td>
</tr>
<tr>
<td><em>Trichophyton species</em></td>
<td>19</td>
<td>3.9</td>
</tr>
<tr>
<td><em>Trichophyton mentagrophytes</em></td>
<td>16</td>
<td>3.3</td>
</tr>
<tr>
<td>Dermatophyte and a mould or yeast</td>
<td>11</td>
<td>2.2</td>
</tr>
<tr>
<td>Moulds</td>
<td>7</td>
<td>1.4</td>
</tr>
<tr>
<td>Total</td>
<td>493</td>
<td></td>
</tr>
</tbody>
</table>

*Sixteen *T. tonsurans* isolates are included here as it was later demonstrated that some *T. rubrum* strains were erroneously classified as *T. tonsurans* up to 1997.
Discussion

Onychomycosis is uncommon in children,9–11,16 and the reported prevalence is between 0.2%16 and 2.6%.10 Most studies report data closer to the lower range and Gupta et al.9 in a large study reported a prevalence of 0.44%.

The number of children (0–18 years of age) diagnosed with onychomycosis before 31 December 2000 was 86. At that date 78 162 children lived in Iceland; thus the percentage of children with onychomycosis or history of onychomycosis was 0.11% in Iceland.

In the current study we estimated the ratio of children with onychomycosis diagnosed before the age of 18 in the Icelandic paediatric population by including all children with positive dermatophyte cultures younger than 18 years of age on 31 December 2000. As this study is not a cross-sectional study, it is likely to underestimate the number of children with onychomycosis as it only includes cases where children sought help for this problem. However, we believe that parents with a child with a nail problem are more likely to seek help than an adult with a nail problem. The strength of our analysis is that it includes all cases diagnosed in Iceland during the study period and that it is based on the National Register of Persons in Iceland,15 the size of the Icelandic paediatric population is known. The study does not run the risk of a bias that can interfere when studies are performed on selected populations. In a population-based study the prevalence of onychomycosis was estimated to be 8.4%1 in adults and thus the prevalence in the adult population could be at least 38 times the prevalence in the paediatric population.

The annual incidence was low, but increased from 1.65 per 100 000 children in 1982–85 to 21.30 per 100 000 children in 1996–2000. The reason for this is possibly a real increase in incidence and/or an increased awareness of this disorder. The incidence of positive dermatophyte cultures was 342 per 100 000 inhabitants in the Icelandic population in the year 2000.17 The incidence in the adult population could therefore be 16 times that of the paediatric population. Onychomycosis does not seem to be more common in Icelandic children compared with figures available from the literature. In adults the prevalence of onychomycosis in Iceland seems to be among the highest reported worldwide.1

This study has demonstrated that 30% of childhood nail dystrophies turned out to be dermatophyte onychomycosis. As in adults, T. rubrum is the most common pathogen. Yeasts were isolated in 31 cases and it is likely that some of these cases are real onychomycosis cases. As this was a retrospective study and no information was available regarding clinical signs or results of the microscopy, other than positive or negative, we chose not to include cases with a growth of a mould or yeast.

Although more samples were taken from girls (55% of the samples), the rate of positive samples was higher in boys (37.4% vs. 24%). Either nail changes are more common in girls or parents are more likely to seek help for girls with nail changes. However, it seems that nail changes in boys who seek help for such problems are more often caused by onychomycosis.

Onychomycosis is extremely rare in the youngest children and only eight cases were identified during the entire period in children younger than 5 years of age. Onychomycosis seems to be very rare in the fingernails in Icelandic children.

The fact that onychomycosis is rare in children has been explained by faster nail growth in children than in compared to adults. In children, the nail surface is smaller, the nails are thinner and cumulative trauma is less than in adults.

References

6 Lateur N, Mortaki A, Andre J. Two hundred ninety-six cases of onychomycosis in children and teenagers: a 10-year