Glans penis and prepuce colonisation of yeast fungi in a paediatric population: pre- and postcircumcision results

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Summary

The members of the genera Candida and Malassezia comprise opportunistic yeast with a natural habitat on the skin of humans and warm-blooded animals. This study aimed to compare the prevalence of these yeast fungi in samples from the glans penis and prepuce 3–5 min prior to circumcision and after 1-month follow-up by mycological examination. A total of 77 children aged between 0.01 and 13.0 years (mean age 5.8 ± 3.4) were included in the study. Impression preparations were made on modified Dixon and Leeming-Notman agars without cycloheximide. The isolates were identified by morphological, biochemical and physiological characteristics. The frequency of yeast colonisation was found to be significantly decreased from 11.7% to 1.3% following circumcision (P = 0.008). The glans penis and prepuce were colonised especially with Candida albicans (50%) followed by Malassezia furfur (40%) and Malassezia sympodialis (10%). This study highlighted the potential medical benefits of circumcision as a significant factor decreasing the colonisation rate of yeast fungi. We suggest that circumcision, rather than age, plays an important part in the reduction of yeast fungi in genitalia.

Key words: Children, circumcision, glans penis, Malassezia, Candida.

Introduction

The yeast of the genus Malassezia are present in 90–100% of people as a normal part of the skin flora: frequency and density of the pathogens are related to patient’s age, regional sebaceous glands and genital secretions.1 They are also associated with a number of diseases affecting the human skin, such as pityriasis versicolor (PV), folliculitis, seborrhoeic dermatitis and dandruff, atopic dermatitis and psoriasis. Pityriasis versicolor is a chronic superficial disease usually affecting the trunk, upper arms, neck or back with most cases occurring during adolescence and young adulthood.1,2

In 1971, it was Blumenthal [3] who first described PV of penis. However, penile involvement is uncommon and presents as discrete, circinate, finely scaling hypopigmented areas on the penile sheath and glans penis which fluoresce in Wood’s light.1–6 Nia and Smith [5] reported that five (7.1%) cases of PV affecting the penile skin were diagnosed among 70 men in the United Arab Emirates. The authors also noted that in hot climates, involvement of the skin is frequently extensive but the genitals are less commonly affected. Recently, it has been described that Malassezia species colonised in glans penis and prepuce of both circumcised and uncircumcised adults as well as children.7–9

In this study, we aimed to determine the efficacy of circumcision on glans penis and prepuce colonisation of yeast fungi with 4-week follow-up by mycological examination in a paediatric population.

Material and methods

Study population

Between June 2005 and October 2006, 77 patients who applied to the outpatient clinic of the Department of
Urology at the Faculty of Medicine, University of Cukurova, were included in the study. With clear statement made of description, objectives and procedures of the study, informed and written consent was obtained from their families.

Follow-up
During the period of the study, all circumcisions were performed by the same surgeon to remove adequate amount of prepuce after injection of local anesthetic. We obtained two cultures from each child, using the initial cultures taken 3–5 min before circumcision. Patients were followed-up once, 4 weeks postcircumcision, were examined by the same clinician, and the same procedures were carried out during their visit.

Media and sampling procedure
The diagnosis was made by an impression preparation of the glans penis on mDixon and Leeming-Notman media. Both media were prepared with chloramphenicol, but without cycloheximide, to allow isolation of all species of Candida. These two media were always used within 1 week of preparation. The plates were incubated in air at 32 °C in a moist atmosphere. Cultures were examined daily over a period of 14 days. Positive results were then evaluated for the number, colour and composition of yeast colonies according to Mayser et al.7-9

Colony morphology
Malassezia yeast were identified as pale ochre-brown waxy or crumbly colonies with a smooth/rough surface, however, Candida spp. as typical cream-coloured, smooth/rough surfaced, soft colonies.7-11 All positive cultures were semiquantitatively evaluated after 10 days of incubation as (+) if one colony was formed, (++) for two to five colonies, and (+++) for more than five colonies.7-9

Identification of Malassezia species
Malassezia yeast were identified based on the microscopic observation of cells and physiological properties such as presence of catalase and the ability to utilise Tween compounds.9 The following reference strains were obtained from Centraalbureau voor Schimmelcultures (CBS), Utrecht, The Netherlands: Malassezia furfur CBS 1878, Malassezia globosa CBS 7966, Malassezia obtusa CBS 7968, Malassezia restricta CBS 7877, Malassezia slooffiae CBS 7861 and Malassezia sympodialis CBS 7222.

Identification of Candida species
Candida species were identified by germ-tube formation in human serum at 37 °C for 2 h. by micromorphology on cornmeal agar-Tween 80 according to the Dalmau method, and by using the commercial API20C AUX (bio-Merieux, Marcy-l’Etoile, France) system.12

Statistical analysis
Mann–Whitney U and McNemar tests were used for non-parametrical data.

Results
The mean age of participants was found to be 5.8 ± 3.4 years (ranging between 0.01 and 13.0). Among 77 children, mycological examination revealed the presence of yeast in nine (11.7%) and in one (1.3%), before and at 1-month follow-up after circumcision respectively. This decrease was found to be statistically significant (McNemar $P = 0.008$).

The most common isolated species was Candida albicans in five out of 10 (50%) followed by M. furfur in four (40%) and M. sympodialis in one (10%). The mean age was not found to be significantly different between children colonised with Malassezia spp. (5.5 ± 3.7) and Candida spp. (7.6 ± 1.7) (Mann Whitney U-test = 6.50, $P = 0.413$). Both study media were found to present identical results of isolation (Table 1).

Discussion
Circumcision has been documented as part of religious rites and tribal customs in sun-worshipping cultures of Egypt and Greece as early as 4000 BC. Jewish and Muslim religions continue the procedure as part of their belief.13 There is evidence that circumcision prevents carcinoma of the penis and phimosis as well as balanoposthitis.14,15 Wiswell et al. [16] concluded that during the first 6 months of life, the presence of a prepuce is associated with a greater quantity of periurethral bacteria and greater likelihood for the presence of high concentrations of uropathogens. Uncircumcised boys have a higher risk of these infections (10- to 20-fold) compared with their circumcised
counterparts. 

Roberts [13] stated that approximately 1% frequency of urinary tract infections was observed in uncircumcised male infants, and that, if circumcisions were no longer done in the United States, it would be expected that ‘20,000 cases of acute pyelonephritis might occur annually.

Mycotic penile infections can be divided into two pathogenic categories: superficial and disseminated. Superficial mycotic infections of the penis by yeast, especially of the genus Candida, are much more common than dermatophyte infections. It is generally sexually acquired, although carriage of yeast on the penis is common, being 14–18% with no significant differences between carriage rates in circumcised or uncircumcised men. Consistent with these reports, David et al. [20] reported penile Candida colonisation in 74 (16%) of the 462 men who attended a sexually transmitted diseases clinic in Coventry, UK. Of the 74 patients with penile colonisation, 26 (37%) were symptomatic and 20 (27%) had balanitis. Also, Schaller et al. [21] isolated Candida spp. in 26.6% of 1000 young men by using impression method. Penile carriage and symptomatic balanitis are mostly associated with sexual partners who have vaginal candidosis.

The colonisation of yeast of the genus Malassezia on the glans penis and prepuce was reported, to date, by three studies, two observed in adult age, one in paediatric population. First, Mayser et al. [7] reported Malassezia colonisation in 64 (49.2%) out of 130 mostly uncircumcised men, isolating Candida spp. in 27 (20.8%), Candida and Malassezia spp. in 14 (10.8%). Among all six lipophilic species they had isolated, M. sympodialis and M. globosa were the most common species like in other human skin areas. Second, we observed yeast isolation in 55 (22.4%) out of 245 circumcised males, with species isolated as Malassezia in 17 (30.9%), Candida in 36 (65.5%), Malassezia and Candida in one (1.8%) and Saccharomyces cerevisiae in one (1.8%). Of the four of the lipophilic yeast, we detected of this genus, M. furfur was found to be the most predominant species. 

From a public health point of view, in addition to lower the risk of viral and bacterial infections in circumcised males, a recent study by our group reported a significantly higher prevalence of yeast in samples from the prepuce and glans penis uncircumcised boys (62.5%) compared to those of circumcised boys (37.5%) (P < 0.01), with the most common species as M. globosa, followed by M. furfur, M. slooffiae and Candida spp. As a result, these three above-mentioned studies suggest that circumcision significantly decreases the colonisation of yeast fungi in glans penis and prepuce such that infrequent isolations were found in both circumcised adults and children. In this further study, these results were confirmed in that colonisation of yeast fungi in childhood period was significantly reduced from 11.7% to 1.3% following circumcision (P = 0.008) and confirmed the results of our recent report.

As was stated by Mayser et al. [7] the preputial space is an intertriginous area and the resident flora of this area depends on age, sexual activity and individual hygiene behaviour. As this area is a damp, warm and primarily anaerobic environment with a neutral to alkaline pH, there is a predisposition to bacterial and mycotic infections. Also, the production of smegma, which consists of 26.6% fat and 13.3% proteins, by multilayer squamous epithelium makes this area a lipid rich environment contributing to the occurrence of lipophilic yeast.

On the other hand, in literature, PV of penis is reported in a limited number of studies. This may be due to the lower pH (4.5) of vagina and lack of lipid

### Table 1 Distribution of yeast fungi on glans penis and prepuce of children prior to and following circumcision

<table>
<thead>
<tr>
<th>Case no</th>
<th>Age (years)</th>
<th>Precircumcision</th>
<th>Postcircumcision</th>
<th>m-Dixon</th>
<th>LN agar</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>Malassezia furfur</td>
<td>M. furfur</td>
<td>++/+</td>
<td>++/++</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
<td>M. furfur</td>
<td>-</td>
<td>++</td>
<td>++</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>M. furfur</td>
<td>-</td>
<td>+++</td>
<td>++</td>
</tr>
<tr>
<td>4</td>
<td>10</td>
<td>M. sympodialis</td>
<td>+</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>Candida albicans</td>
<td>-</td>
<td>++</td>
<td>++</td>
</tr>
<tr>
<td>6</td>
<td>7</td>
<td>C. albicans</td>
<td>-</td>
<td>++</td>
<td>++</td>
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<td>7</td>
<td>8</td>
<td>C. albicans</td>
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</tr>
<tr>
<td>9</td>
<td>9</td>
<td>C. albicans</td>
<td>-</td>
<td>+</td>
<td></td>
</tr>
</tbody>
</table>

LN, Leeming-Notman agar.

+ if one colony was formed after 10 days; ++ if two to five colonies were formed after 10 days; +++ if more than five colonies were formed after 10 days.
sources, which are not optimum for the growth of Malassezia.\textsuperscript{7} As the role of Malassezia – a pathogen in the region of male genitalia – is not very obvious, we conclude that circumcision helps to reduce Malassezia colonisation. But the reduction in humidity may be also not the cause, as it may be in the case of Candida colonisation. Moreover, the reduction in sebum is not also conceivable as a factor, as the study group is a paediatric population. However, changes in the skin pH caused by circumcision may play a crucial role in the glans penis colonisation of the yeast of the genus Malassezia.

As literature concerning colonisation of yeast fungi including pre- and postcircumcision results is almost non-existent, this study may be regarded as the first of its kind, dealing with genital colonisation prior and following circumcision.

References