Age-specific Prevalence Rates of Phimosis and Circumcision in Taiwanese Boys

Ming-Chung Ko,1,2 Chih-Kuang Liu,1,3 Wen-Kai Lee,1 Huey-Sheng Jeng,7 Han-Sun Chiang,3 Chung-Yi Li2 *

Background/Purpose: To estimate the age-specific prevalence rates of phimosis and circumcision in an urban sample of Taiwanese boys.

Methods: A convenience sample of 1145 boys aged from 7 to 13 years was enrolled and cross-sectionally evaluated for preputial retractability and status of circumcision. Another convenience sample of 59 newborn male infants was enrolled from the infant room of a city municipal hospital. These infants were examined for preputial development at birth.

Results: None of the newborn male infants had a completely retractable prepuce (i.e. type 3). The prevalence rate of type 3 prepuce increased with age from 71.7% (95% confidence interval [CI], 66.5–75.5%) for boys aged 7 years to 72.4% (95% CI, 67.3–77.0%) for boys aged 10 years and 84.1% (95% CI, 79.6–88.0%) for boys aged 13 years. In contrast, the prevalence rate of type 1 prepuce decreased with age from 83.1% (95% CI, 71.0–91.6%) for newborn infants to 0.3% (95% CI, 0.0001–1.8%) for boys aged 13 years. On the other hand, the prevalence of circumcision slightly increased with age from 7.2% (95% CI, 5.3–10.8%) for boys aged 7 years to 8.7% (95% CI, 6.5–13.3%) for boys aged 13 years.

Conclusion: Nonretractability of the prepuce was very common among the Taiwanese newborns. Among the school boys, the degree of preputial separation and exposure of glans increased with age and progressed even more rapidly in adolescence. Very few boys still suffered from unretractable prepuce by the age of 13.


Key Words: circumcision, phimosis, prepuce

Phimosis, common in the newborn and infants, is recognized as an inability to retract the prepuce over the glans. Many parents worry about this condition in children and consider unretractability of the prepuce as an indication for circumcision.1 There is much debate and disagreement among doctors with regard to the indications for circumcision.2 The American Academy of Pediatrics reported that newborn circumcision has potential medical benefits and advantages as well as disadvantages and risks.3 The medical advantages of circumcision include prevention of urinary tract infection, balanoposthitis, pathologic phimosis, and penile cancers. The medical disadvantages of circumcision include pain, requirement of anesthesia, and possible contraindications and complications. Although controversy regarding whether neonatal circumcision should be performed remains, circumcision is still prevalent in many areas of the world. For example, between 1979 and 2003, the percentage of male infants who were circumcised in hospitals in the United States

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remained relatively constant, ranging between 56% and 65%.4

Physiologic phimosis, an inability to retract the prepuce due to preputial adhesion to the glans penis, is not uncommon in male newborns. However, the degree of preputial retractability increases with age and the stage of preputial separation varies greatly among individuals.5,6 Gairdner reported that about 90% of prepuces become retractable by the age of 3 years in European boys, suggesting that many circumcisions are unnecessary.5 In Taiwan, Su and Yin investigated the preputial condition of fifth and sixth grade elementary school students in the city of Kaohsiung, and reported that the rates of easily retractable prepuce and circumcision were 62.8% and 7.6%, respectively.7

There have been very few studies, however, of preputial development and the prevalence of circumcision in Taiwanese boys.1,7 In this study, we examined preputial retractability and the status of circumcision in 1204 boys of different ages in Taipei City. The age-specific prevalence of circumcision and phimosis were calculated. The results may be informative about the sequential progression of preputial development in Taiwanese boys.

Materials and Methods

This was a cross-sectional analysis of a convenient urban sample of Taiwanese boys. A physical check-up program was implemented in all elementary school and junior high school boys of Taipei City between October and November, 2001. All students in the first, fourth, and seventh grades (i.e. 7-, 10-, and 13-year-olds, respectively) underwent physical examinations, which included evaluation of external genitalia for physical abnormality. Among the students in this program, 1145 boys who were checked by the same urologist comprised the participants of this study. They included 433, 367, and 345 boys in the first, fourth, and seventh grades, respectively. In addition to these school boys, we also investigated the development of the prepuce in another 59 male newborns enrolled from the infant room of a municipal hospital in Taipei City. The parents or primary caregiver of all study participants signed an informed consent form before the physical examination took place.

Before manual retraction of the prepuce was performed, the status of preputial covering over the glans penis was checked. Then, the prepuce of each subject was gently retracted without traumatic force, and the degree of glans exposure was recorded. The same urologic specialist performed all examinations. With the classification modified from Kayaba et al’s study,9 the prepuce was classified into the following three types based on the extent of retractability and glans exposure: type 1 (highly unretractable) was defined as no retraction of the prepuce at all or external urethral meatus exposure only; type 2 (intermediate) was defined as glans exposure about halfway to the coronal sulcus; and type 3 (completely retractable) was defined as nearly total or total exposure of the glans (Figure 1). The preputial condition causing unretractability was recorded according to whether a scarred constrictive was noted. The status of circumcision as recognized from an operation scar was also recorded.

Percentages were calculated to estimate the age-specific prevalence rates of phimosis and circumcision and the corresponding confidence intervals (CIs) using the methods reported by Blyth and Still.9 Trends in age-specific prevalence rates of phimosis and circumcision were also presented graphically. The statistical analyses were performed using

![Figure 1](image-url)
both SPSS software Chinese version 12.0 (SPSS Inc. Chicago, IL, USA) and STATXACT 5.0 (Cytel Software Corp., Cambridge, MA, USA).

Results

Before manual retraction of the prepuce, almost all of the uncircumcised boys aged 0, 7, and 10 years had a complete preputial covering over the glans penis. Of the 315 uncircumcised boys aged 13 years, 169 boys (53.7%) had a complete preputial covering, 143 (45.4%) had a partial preputial covering, and three (0.9%) had a completely exposed glans (Table 1). After manual retraction, none of the newborn male infants had a completely retractable prepuce (i.e. type 3). The prevalence rate of type 3 prepuce increased with age from 71.7% (95% CI, 66.5–75.5%) at 7 years of age to 72.4% (95% CI, 67.3–77.0%) at 10 years and 84.1% (95% CI, 79.6–88.0%) at 13 years. In contrast, type 1 prepuce was most prevalent among newborns (83.1%; 95% CI, 71.0–91.6%) and the prevalence rate decreased monotonically with age, with a rate of 4.5% (95% CI, 2.7–7.0%), 1.5% (95% CI, 0.5–3.4%), and 0.3% (95% CI, 0.001–1.8%) in subjects aged 7, 10, and 13 years, respectively. The prevalence rate of type 2 prepuce for boys aged 7 and 10 years was 24.4% (95% CI, 20.3–28.9%) and 26.2% (95% CI, 21.6–31.2%), respectively, which was higher than that for boys aged 13 years (15.6%; 95% CI, 11.7–20.0%) (Table 2). With regard to the appearance of preputial unretractability (i.e. type 1 or 2 prepuce), among the uncircumcised boys, all of the newborns suffered from an unscarred pliant, preputial narrowing, or preputial adhesion. Additionally, a scarred constriction ring was noted in five boys with type 1 prepuce, with two aged 7 years, two aged 10 years, and one aged 13 years. Balanitis was noted in three uncircumcised boys, with two (one with type 1, the other with type 2 prepuce) aged 7 years, and one (type 1 prepuce) aged 10 years. None of the newborns had undergone circumcision. The prevalence of circumcision slightly increased with age with prevalence rates for boys aged 7, 10, and 13 years of 7.2% (95% CI, 5.3–10.8%), 7.4% (95% CI, 4.5–9.7%), and 8.7% (95% CI, 6.5–13.3%).

Table 1. Before retraction, the degree of preputial covering over glans penis in the uncircumcised boys of different age

<table>
<thead>
<tr>
<th>Age (yr)</th>
<th>Completely covered, n (%)</th>
<th>Partially covered, n (%)</th>
<th>Not covered at all, n (%)</th>
<th>Total,* n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>59 (100.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>59 (100.0)</td>
</tr>
<tr>
<td>7</td>
<td>392 (97.5)</td>
<td>10 (2.5)</td>
<td>0 (0.0)</td>
<td>402 (100.0)</td>
</tr>
<tr>
<td>10</td>
<td>327 (96.3)</td>
<td>13 (3.7)</td>
<td>0 (0.0)</td>
<td>340 (100.0)</td>
</tr>
<tr>
<td>13</td>
<td>169 (53.7)</td>
<td>143 (45.4)</td>
<td>3 (0.9)</td>
<td>315 (100.0)</td>
</tr>
</tbody>
</table>

*Based on 1116 study boys without circumcision.

Table 2. Age-specific prevalence of prepuce and circumcision among the study boys

<table>
<thead>
<tr>
<th>Age (yr)</th>
<th>Type 1†</th>
<th>Type 2‡</th>
<th>Type 3§</th>
<th>Circumcision¶</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
</tr>
<tr>
<td>0</td>
<td>49 (83.1, 71.0–91.6)</td>
<td>10 (16.9, 18.4–29.0)</td>
<td>0 (0.0, 0.0–6.1)</td>
<td>0 (0.0, 0.0–6.1)</td>
</tr>
<tr>
<td>7</td>
<td>18 (4.5, 2.7–7.0)</td>
<td>98 (24.4, 20.3–28.9)</td>
<td>286 (71.7, 66.5–75.5)</td>
<td>31 (72, 5.3–10.8)</td>
</tr>
<tr>
<td>10</td>
<td>5 (1.5, 0.5–3.4)</td>
<td>89 (26.2, 21.6–31.2)</td>
<td>246 (72.4, 67.3–77.0)</td>
<td>27 (74, 4.5–9.7)</td>
</tr>
<tr>
<td>13</td>
<td>1 (0.3, &lt;0.1–1.8)</td>
<td>49 (15.6, 11.7–20.0)</td>
<td>265 (84.1, 79.6–88.0)</td>
<td>30 (87, 6.5–13.3)</td>
</tr>
</tbody>
</table>

*Based on 1116 study boys without circumcision; †based on all 1204 study boys; ‡type 1 = highly unretractable prepuce, type 2 = intermediate, type 3 = completely retractable prepuce. ¶Cl = confidence interval.
6.5–13.3%) (Table 2). Trends in age-specific prevalence of phimosis and circumcision are also illustrated in Figure 2. There was a clear decreasing trend for type 1 prepuce and an apparent increasing trend for type 3 prepuce. Additionally, the prevalence of circumcision also increased gradually with age.

Discussion

The prepuce forms the anatomical covering of the glans. The outer epithelium has the protective function of internalizing the glans and urethral meatus, thus decreasing external irritation or contamination.10 Our data showed that almost all uncircumcised boys aged 0, 7, and 10 years had a complete preputial covering over the glans. On the other hand, 143 (45.4%) had a partial preputial covering, and three (0.9%) had a fully exposed glans among the uncircumcised boys aged 13 years. A higher prevalence of preputial covering among young children is due to the fact that the immature glans of young children are more vulnerable and need more protection from chemical or mechanical injuries.

Separation of the prepuce from the glans is a developmental process and begins by 24 weeks of gestation. The stage of preputial separation varies greatly among individuals.5,6 Some investigators argued that preputial development should be sufficient by 10 days of life to allow mechanical retraction without tearing of the epithelium.11 However, our study suggests that there is little likelihood that retraction could be performed without tearing in all newborns. None of the newborns in this study had a type 3 (completely retractable) prepuce. Our findings indicate that the degree of preputial retractability increases with age, while the prevalence of unretractable prepuce decreases with age. By the age of 13 years, very few boys (some 0.3%) still had an unretractable prepuce (i.e. type 1 prepuce). These findings are in agreement with the study by Kayaba et al, who investigated the preputial development of 603 Japanese boys and found the prevalence of highly unretractable prepuce decreased from 70% at the age of 6 months to less than 10% after 5 years of age.8 In contrast, the prevalence rate of type 3 prepuce increased with age from 0% for newborn infants to 71.7%, 72.4%, and 84.1% for boys aged 7, 10, and 13 years, respectively. Another previous study conducted in the city of Kaohsiung, Taiwan, in 2001 reported that, with the classification of Kayaba et al’s study, 62.8% of boys aged 10–13 years had a completely retractable prepuce.7 This figure is lower than the prevalence observed in the present study. The possible explanation for such a discrepancy is that the physical check-up was performed by different physicians and the force applied to retract the prepuce as well as interpretation of preputial retractability could be different among physicians. In the present study, the physical check-up was performed by a single urologist. The type 2 prepuce could be considered as an intermediate status during the process of preputial separation and the prevalence rate for boys aged 7 and 10 years was higher than that for boys aged 13 years.

In the present study of Taiwanese boys, preputial development progressed even more rapidly in the period from 10 to 13 years. Boys aged 13 years were more likely to have type 3 prepuce than boys aged 7 and 10 years. In an animal model of male rats, preputial separation was shown to be androgen-dependent and to occur around the

Figure 2. Cross-sectional trends in age-specific prevalence of circumcision and phimosis of various types.
time of puberty in male rats. Horita et al reported that the frequency of nocturnal penile tumescence had a tendency to increase with age with a maximum frequency at 13 or 14 years of age and tumescence time was greater in children over 12 years of age. Furthermore, the maximum increase in penile circumference was greater in children over 12 years of age as compared to children below 10 years of age. The increase in frequency and duration of physiologic erection in adolescence may facilitate preputial separation. With the understanding of normal development of the prepuce, unnecessary circumcision and general anesthesia may be prevented in preschool boys.

Circumcision is one of the most common procedures performed in males. In the United States, approximately 65.3% of newborns were circumcised in 1999. In Canada, circumcision rates are relatively low, ranging from 10% to 30%. The procedure is uncommon in northern European countries; for example, the cumulative national circumcision rate in Denmark was around 1.6% by the age of 15 years. Circumcision is performed due to social or religious reasons in some areas and countries, while in Taiwan the rate of circumcision indicated for these factors was low, with a reported rate of 1.4%. Although neonatal circumcision is not common in Taiwan (none of the newborn infants had received circumcision in our series), the prevalence of circumcision in school boys in this study was 7.67% on average, which was similar to that (7.6% for boys aged 10–13 years) reported from a previous study in Taiwan. The prevalence of circumcision was much higher than those of Scandinavian countries, where less than 2% of boys are circumcised.

Many parents have their children circumcised due to unretractability of the prepuce. With regard to the medical indications for circumcision, the proportions of procedures indicated for phimosis ranged from 80.6% to 90.2%. A study conducted by Spilsbury et al in Australia from 1981 to 1999 reported that 4% of all boys were circumcised for phimosis before the age of 15 years. To clarify, Rickwood et al emphasized the differentiation of physiologic phimosis, an unscarred pliant preputial narrowing or normal adhesion of the prepuce to glans, from pathologic phimosis, a condition characterized by secondary cicatrization of the orifice. This problem, the only absolute indication for circumcision, affects about 0.6% of boys, with a peak in incidence at 11 years, and is rarely encountered before the age of 5 years. Among the uncircumcised boys in our study, only five boys aged 7–13 years had an unretractable prepuce caused by a scarred constricture ring. Although we did not specifically investigate the indication for the circumcision in this study, we are concerned that some boys with normal preputial development might be mistaken as having pathologic phimosis and underwent unnecessary circumcision.

Balanitis was noted in three boys aged 7–10 years, with two having type 1 prepuce, and one having type 2 prepuce. Balanitis is usually associated with a unretractable prepuce; however, it rarely causes pathologic phimosis. Most boys have a single episode and circumcision is indicated for those with troublesome recurrence. Unretractable prepuce has been considered responsible for colonization of the prepuce by pathogens, which leads to urinary tract infection. An association between a decreased incidence of urinary tract infection and circumcision during the 1st year of life has been reported. However, the periurethral colonization that occurs in uncircumcised male infants during the first few weeks of life may gradually decrease during the 1st year and may disappear after the age of 5 years. After taking into consideration the low incidence of urinary tract infection in uncircumcised male infants and the associated risks and complications of circumcision, many studies did not find urinary tract infection to be a decisive reason for circumcision.

Nonretractability of the prepuce was very common among the Taiwanese newborns. Among the school boys, the degree of preputial separation and exposure of glans increased with age and progressed even more rapidly in adolescence. Very few boys still suffered from unretractable prepuce by the age of 13 years. With the knowledge of normal preputial development, unnecessary circumcision
and general anesthesia may be prevented in preschool boys.

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