Concealed Penis after Circumcision: Is It Beneficial in Lowering Uropathogenic Colonization in Penile Skin and Preventing Recurrence of Febrile Urinary Tract Infections?

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**Purpose:** To discuss whether concealed penis after circumcision lowers perimeatal urethral and glanular sulcus uropathogenic bacterial colonization in healthy boys with no urinary tract problems and prevents attacks of febrile urinary tract infections in non-healthy boys with defined urinary tract abnormalities.

**Materials and Methods:** This case-control study was conducted in Ibn-i Sina Hospital and retrospectively collected data of 471 boys were analyzed. All patients were scanned for any urinary tract abnormality and those with any defined abnormalities were classified as non-healthy group. (123 patients) Non-healthy patients were divided into two subgroups as concealed (n:31) and non-concealed (n:92) penis after circumcision. Healthy patients with no urinary problems were divided into three groups as circumcised without concealed penis (n:144), with concealed penis after circumcision (n:104) and uncircumcised control group (n:100). Bacterial cultures were obtained from both periurethral meatal and glanular sulcus areas by adhering strictly to the rules of obtaining bacterial culture to avoid false-positive or negative culture results. Also only uropathogenic bacteria were evaluated, irrelevant results were excluded.

**Results:** Mean age was similar in healthy population. Comparison of three groups showed that there was a significant difference in both cultures. (P = .026 for periurethral meatal region, P = .039 for glanular sulcus region) In post hoc analysis, non-concealed group had a lower rate of culture positivity in both areas compared to other groups. Mean age was also similar in non-healthy population. Mean follow-up period was 18.2 months. Patients with concealed penis after circumcision had a significantly higher number of febrile UTI attacks (20 attacks in 8 patients vs 7 attacks in 5 patients) compared to non-concealed group. (P = .019) All febrile UTI attacks except one in this group occurred below the age of 12 months. A total of 10 patients in both healthy and non-healthy groups had postoperative hemorrhage after circumcision and only 1 patient had a wound infection.

**Conclusion:** Concealed penis after circumcision does not lower perimeatal urethral and glanular sulcus uropathogenic bacterial colonization in healthy patients and does not protect unhealthy patients from febrile urinary tract infection attacks. If circumcision is planned, concealed penis should be avoided and also parents should be informed about the possible risks due to concealed penis before the procedure, particularly in patients with urinary tract abnormalities.

**Keywords:** circumcision; colonization; glans; urethral; urinary tract infection

**INTRODUCTION**

Circumcision is the surgical excision of the prepuce. It has been performed as a surgical procedure since ancient times. Males were circumcised inspired by religious beliefs or social traditions over years, particularly in Muslim and Jewish populations. Many boys in United States undergo circumcision in their first year of life.¹² In contrast to these examples, in UK and European countries circumcision is not performed routinely for every boy, but only for boys whose parents prefer or doctors recommend. Scandinavian culture is known to be more strict about the preservation of the foreskin, and as a result Nordic countries have the lowest rate of circumcision in the westernized societies. Though there are different approaches to circumcision in distinct populations, contributions of circumcision to improve public health have been proved in recent years by several studies including large samples.¹³ Boys who have no anatomical or functional urinary tract problems and no urogenital diseases such as recurrent balanoposthitis, balanitis xerotica obliterans (B XO), paraphimosis or phimosis generally do not need circumcision along life. The main benefit of circumcision which has been shown in many studies from different centers is that it lowers bacterial colonization in penile skin.¹⁴ In a prospective randomized study including 197 patients, Gücük A et al.

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evaluated the effect of circumcision on periurethral pathogenic bacterial flora.\textsuperscript{(5)} The study concluded that circumcision significantly decreases the pathogenic bacterial colonization and combined with antibiotic prophylaxis, circumcision prevents recurrent and febrile UTIs. This effect of circumcision is particularly beneficial for patients with urinary tract abnormalities, such as posterior urethral valve (PUV), vesicoureteral reflux (VUR), ureteropelvic junction (UPJ) obstruction or obstructive megaureter. Although this colonization causes no significant problems in healthy patients, patients with anatomical or functional urinary problems would have recurrent febrile urinary tract infections (UTIs) due to the increased rate of uropathogenic bacterial colonization in penile skin.\textsuperscript{(5)} Kose et al. investigated the effect of circumcision on frequency of UTIs in 134 boys with antenatal hydrenephrosis.\textsuperscript{(5)} The results showed that the pre-circumcision UTI frequency (2.97 ± 1.14/year) was significantly higher than the post-circumcision (0.25 ± 0.67/year) period. ($P < .05$) Circumcised penis is a relatively new definition in the urologic literature. It refers to a redundant skin after circumcision and causes the glans seem like “concealed”. The main cause for concern in these patients is the possibility of inadequate reduction of bacterial colonization in penile skin, particularly in glanular sulcus region, because of the redundant skin covering glanular sulcus as in uncircumcised males. Studies comparing circumcised and uncircumcised healthy boys for uropathogenic bacterial colonization rates declare that non-circumcised boys have higher colonization rates.\textsuperscript{(5)} However, we do not have sufficient data about patients who have concealed penis after circumcision. In this study, we aimed to investigate whether concealed penis is effective to lower the uropathogenic bacterial colonization in penile skin of healthy children or to prevent recurrent febrile UTI attacks in boys with urinary tract abnormalities.

**MATERIALS AND METHODS**

Our research was a case-control study and conducted in Ibn-i Sina Hospital in Ankara University Faculty of Medicine with a retrospective design. The data of 471 boys who referred to our pediatric urology clinic between March 2010 and September 2014 was collected and evaluated.

**Study Population**

There were two different populations in our study as healthy and non-healthy boys which referred to patients with no urinary tract problems and defined urinary tract abnormalities respectively. Scanning process for any urinary tract malformation was performed in our clinic. All members of non-healthy group had a follow-up schedule on a patient specific basis.

Healthy patients were classified into three groups. Group 1 consisted of 144 (41.3 %) circumcised boys without concealed penis whereas group 2 included 104 (29.8 %) boys with a concealed penis after circumcision and group 3 (control group) consisted of 100 (28.7 %) uncircumcised boys without phimosis. In addition, records of 123 unhealthy circumcised boys with a diagnosed urinary abnormality such as VUR, PUV, UPJ obstruction, obstructive megaureter, neurogenic bladder related to spina bifida were retrospectively analyzed to evaluate the post circumcision frequency of febrile UTI attacks in concealed and non-concealed groups. 31 of these patients (25 %) had concealed penis after circumcision.

**Inclusion and Exclusion Criteria**

The participants had no phimosis and history of recurrent balanoposthitis. (2 times or more in total) Patients with serious complications after circumcision such as meatal stenosis or urethral fistula, patients with post circumcision scarring, patients who were uncircumcised or had concealed penis after circumcision and perform regular cleaning of glans penis, unhealthy patients who lack their follow-up were excluded to avoid any possible bias. Inclusion-exclusion assessment was done by one physician.

**Procedures**

We accepted patients who had penile skin covering 1/3 or more of the glans after circumcision as concealed. A swab was swept circumferentially once around the periurethral meatus and glanular sulcus regions. Afterwards, bacterial cultures were obtained from both of the areas, by adhering strictly to the rules of obtaining bacterial culture to avoid false positive or negative culture results, for detection of

**Table 1. Positive uropathogenic bacterial culture rates in three groups.**

<table>
<thead>
<tr>
<th>Healthy Population With No Urinary Tract Abnormalities</th>
<th>Group 1 Circumcised Boys Without Concealed Penis</th>
<th>Group 2 Concealed Penis After Circumcision</th>
<th>Group 3 Uncircumcised</th>
<th>Total</th>
<th>$P$ Value Analysis Of Three Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Age (Years)</td>
<td>6.12 ± 0.7</td>
<td>6.15 ± 0.6</td>
<td>6.36 ± 0.8</td>
<td>6.2 ± 0.7</td>
<td>.15</td>
</tr>
<tr>
<td>Number Of Patients</td>
<td>144 (41.3 %)</td>
<td>104 (29.8 %)</td>
<td>100 (28.7 %)</td>
<td>348</td>
<td></td>
</tr>
<tr>
<td>Percentage Of Positive</td>
<td>29.6 %</td>
<td>62.6 %</td>
<td>68.9 %</td>
<td>50.7 %</td>
<td>.026</td>
</tr>
<tr>
<td>Uropathogenic Culture In Perineural Mental Area</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percentage Of Positive</td>
<td>43.8 %</td>
<td>69.2 %</td>
<td>77.4 %</td>
<td>61.0 %</td>
<td>.039</td>
</tr>
<tr>
<td>Group 3</td>
<td>Group 2</td>
<td>Group 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$P$ Value For Perineural Meatal Culture</td>
<td>Group 2 $p = .008$</td>
<td>Group 1 $p = .004$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$P$ Value For Glanular Sulcus</td>
<td>Group 2 $p = .011$</td>
<td>Group 1 $p = .011$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$P$ Value For Any Culture</td>
<td>Group 2 $p = .009$</td>
<td>Group 1 $p = .009$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$P$ Values refer to ANOVA analysis, $P$ values refer to post hoc analysis. Bonferroni test was used for post hoc analysis.</td>
<td></td>
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</tbody>
</table>
uropathogenic bacteria. Positive bacterial cultures were consulted to a bacteriologist and results which would be irrelevant were not assessed and only uropathogenic colonies were evaluated.

### Evaluations

Our primary end point in healthy population was rates of uropathogenic bacterial colonization in periurethral meatal or glanular sulcus areas. Total culture positivity in both areas for uropathogenic bacteria was calculated for each group of healthy population. Non-healthy population was evaluated separately and the primary end point was the reduction in number of febrile UTI attacks. Concealed and non-concealed groups were compared for total number of febrile UTI attacks in 18 months’ follow-up.

### Statistical Analysis

We used SPSS 22.0 for statistical analysis. In healthy population, ANOVA analysis was done to compare three groups whether uropathogenic bacterial colonization rates were different. Bonferroni test was used for post hoc analysis. To minimize error in the test, we used α/3 instead of α. In non-healthy population, student t test was used to compare concealed and non-concealed groups for number of febrile UTI attacks. A P value of < .05 was accepted for statistical significance.

### RESULTS

General characteristics of healthy population in the study were summarized in Table 1. Mean age was similar in three groups. Non-concealed group had a higher number of participants than others. As three groups were compared for uropathogenic bacterial colonization rates, the difference was significant in both areas. (periurethral meatal region $P = 0.026$ and glanular sulcus region $P = 0.039$) In post hoc analysis, culture positivity rate of non-concealed group were significantly lower than concealed and uncircumcised groups. (Table 1) However, there was no significant difference between concealed and uncircumcised groups. (Table 1)

Most patients with a positive uropathogenic bacterial culture in the periurethral meatal region had also positive cultures in the glanular sulcus region, except a few participants who had only positive culture in the glanular sulcus region. As culture positivity in any area were compared with ANOVA analysis for three groups, there was a significant difference as expected. ($P = 0.32$) In post hoc analysis, non-concealed group had significantly lower rates of colonization than others. (Table 1) General characteristics for unhealthy population were summarized in Table 2. Mean age was similar in both groups and the mean follow up period was 18.2 months. Non-concealed group had a higher number of patients compared to concealed. 8 patients had 20 febrile UTI attacks in concealed penis group whereas 5 patients had 7 febrile UTI attacks in non-concealed penis group. (Table 2) The difference between recorded number of febrile UTIs was significant. ($P =0.019$) There was no significant difference in number of patients having febrile UTI attacks after circumcision between concealed and non-concealed penis group except one in the non-healthy population occurred below the age of 12 months. 6 (0.01%) patients had postoperative hemorrhage in the healthy group and 4 (0.03%) in the non-healthy group after circumcision. In management of hemorrhage, wrapping the wound with a sterile gauze was successful in 9 of these patients. Only in 1 patient, if required intervention and detailed laboratory examination revealed deficiency of factor 7. After the replacement of factor 7, no persistent hemorrhage was observed. Wound infection was only seen in 1 patient in the non-healthy group that was managed with appropriate antibiotic therapy and did not cause a scar or recurrent infection in penis. No other complication due to circumcision was seen in both groups.

### DISCUSSION

Circumcision is still a conflicting surgical experience though it is widely performed in many countries of the world. Current literature declares that it is not necessary for every boy but recommended particularly for those who have recurrent balanoposthitis or UTI attacks due to defined anatomical or functional urinary tract abnormalities. Most authors agree on circumcision if the benefits outweigh the risks. However, it is not always easy to select right patients to undergo circumcision as each patient with a defined urinary tract abnormality may not have UTI attacks or it is not certain how many times of balanoposthitis require circumcision. As expected in every surgical procedure, circumcision have also complications both in the short and long term. Early complications of circumcision defined in the literature are hemorrhage, wound infection, retention of urine, mental ulceration, glans necrosis and penil amputation whereas long term complications are urethral fistula and meatal stenosis. Hemorrhage is the most common complication of circumcision. During the intervention, surgeon may face with problematic bleeding, use of cautery would be beneficial to control it. In addition, anesthetic agents may have an effect on surgical site hemorrhage in circumcision. Karasu et al. conducted a study including 100 patients com-
paring ketamine+midazolam to sevoflurane+propofol in terms of surgical site hemorrhage in circumci-
sion.(14) They found that the intraoperative bleeding
scores were significantly higher in ketamine+midazon-
lam group. Wrapping the wound with a sterile
gauze circumferentially around the sutured area after
circumcision helps to avoid postoperative bleeding.
The dressing should be removed approximately af-
ter 24 hours, after making sure that there is no
bleeding or oozing. Gently washing the wound for
5-7 days helps prevent postoperative wound infec-
tions. Management of severe complications due to
circumcision is generally complicated and patients
should be referred to tertiary centers for advanced
treatments.

Another issue under debate about circumcision is
the appropriate age for the procedure. Each age pe-
riod in which the surgery has planned has its own
advantages and disadvantages. Neonatal circumcision
has a shorter time of recovery but with the higher
risk of meatal ulceration and stenosis.(15) Males in
phallic period tend to be affected adversely in psy-
chological way due to undergoing a surgery asso-
ciated with their sex organ. School aged boys may
need sedation anesthesia in addition to dorsal penile
nerve block during the procedure.(16) Boys in peri-
pubertal period may have tearing of sutures before
healing is complete due to intermittent nocturnal
erections. Physician should consider both risks and
benefits for each patient and then inform parents
about the procedure. Therefore, favorable age for
circumcision would be different for each individual.

The definition of concealed penis is not clear in the
literature. Although authors agree on that concealed
penis is the appearance of redundant skin covering
glans in circumcised males, there is no consensus
on exactly how much of the glans should be cov-
ered by redundant skin to regard it as concealed
penis. The ideas of authors vary, some declare that
if glanular sulcus is not visible after circumcision,
it should be classified as concealed penis. However,
some declare that if external meatal opening and
most part of glans are clearly visible after circumci-
sion, it should be classified as non-concealed penis.
The point which should be considered here is that
the distance between external meatal opening and
glanular closure line has a direct correlation with
age.(17) Therefore, glanular sulcus would be visible
in some patients after puberty when penis reaches
its ultimate length even it is not visible after cir-
cumcision. In our study, we adopted a reasonable
approach and accepted patients whose penile skin
covered 1/3 or more of the glans after circumcision
as concealed. However, we admit this as a limita-
tion of our study because there is no widely ac-
cepted definition of concealed penis in the literature.
Most authors agree on that concealed penis would
not be regarded as a complication of circumci-
sion, such as other complications mentioned above.
Defining it as a surgical error seems to be more
accurate. Because, healthy patients with no defined
urinary tract abnormalities who have concealed pe-
nis after circumcision generally do not have bala-
noposthitis or UTIs in their whole life despite the
higher rates of bacterial colonization in their penile
skin. Even, some patients may do regular cleaning
of glans penis by the help of their parents as a
preventive measure to decrease penile skin bacte-
rial colonization. Some uncircumcised patients would
also get this benefit. However, in unhealthy patients
with recurrent urinary tract infections due to poor
hygiene of the glans, a second intervention for
removal of the redundant skin in concealed penis
should be considered. We did not include patients
who do regular cleaning of glans penis in our study
to avoid any possible bias. Our study yielded the
result that penile skin bacterial colonization rates
are significantly higher both in uncircumcised and
concealed penis than in circumcised penis. So we
should keep in mind concealed penis as a surgical
error limiting benefits of circumcision.

Circumcision has a protective effect on penis through
the reduction of uropathogenic bacterial colonization
in penile skin. However, concealed penis with its
redundant skin covering glans serves as a base for
uropathogenic bacterial colonization. This causes an
argument about the proved benefit of circumci-
sion. In our study; we also compared uropathogenic
bacterial colonization rates of uncircumcised and
concealed with each other, and found no significant
difference between them in both periurethral meatal
and glanular sulcus cultures. Results obtained from
the unhealthy group also verified our results report-
ed for healthy group, as concealed had significantly
higher number of febrile urinary tract infections. We
think there is a direct correlation between the in-
creased uropathogenic bacterial colonization in penis
and recurrent febrile UTI attacks. As a limitation
of our study, bacterial colonization rates and febrile
UTI attacks were evaluated in different populations.
In addition, we could not report the results of
positive cultures in details including which uropath-
ogenic bacteria was detected in glanular sulcus or
periurethral meatal area. All data in the study were
collected retrospectively so this data lacked in our
study. We also believe that our sample size would
not be adequately large as to provide definitive re-
sults. These limitations would diminish the validity
of the study results. However, we avoided a pos-
sible bias with the exclusion of post-circumcision
scars and serious complications such as urethal
fistula, meatal stenosis or ulceration. We should
exactly state that concealed penis after circumcision
causes lack of penile hygiene.

Our results supported our hypothesis and also were
similar with the current literature. We found a
significantly lower rate of penile uropathogenic bac-
terial colonization in circumcised patients without
concealed penis. In post hoc analysis, there was
no significant difference between concealed and
uncircumcised group. This result showed us that
concealed penis significantly diminishes benefits of
circumcision. In addition, febrile UTI attacks were
significantly higher in patients with concealed penis
compared to non-concealed in the non-healthy pop-
ulation. Our study objective was to highlight these
points. To our knowledge, this is the first study
assessing patients with concealed penis for the risk
of uropathogenic bacterial colonization in penile
skin and recurrent febrile UTI attacks.

As we balance advantages of our study against its
limitations, we realize that our results would
Contribute to the current literature. However, randomized prospective clinical trials including larger samples should be conducted to provide definitive results about concealed penis after circumcision.

**CONCLUSIONS**

As a conclusion, we declare that concealed penis after circumcision does not lower uropathogenic bacterial colonization in penile skin, also it is not protective for recurrent febrile UTI attacks. If circumcision is planned, concealed penis should be avoided. In addition, parents should be informed about the risks of concealed penis before the procedure. In concealed penis after circumcision, a second intervention should be discussed for the removal of redundant skin unless the patient has a normal hygiene of the glans.

**CONFLICT OF INTEREST**

The authors declare that they have no conflict of interest in connection with this article.

**REFERENCES**


