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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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Abstract

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). Patients with phimosis or history of recurrent balanoposthitis, patients with serious complications of circumcision or post-circumcision scarring, patients who perform regular cleaning of glans despite being uncircumcised or having concealed penis and unhealthy patients who lack their follow-up were not included in the study. 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 bacterias were evaluated, irrelevant results were excluded. Healthy patients were compared with ANOVA analysis whereas non-healthy with student t test separately. P value of < 0.05 was considered as statistically significant.

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 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.[1] 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.[2]

Boys who have no anatomical or functional urinary tract problems and no urogenital diseases such as recurrent balanoposthitis, balanitis xerotica obliterans (BXO), 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.[3] In a prospective randomized study including 197 patients, Gücük A et al evaluated the effect of circumcision on periurethral pathogenic bacterial flora.[4] 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.[5] Kose E et al investigated the effect of circumcision on frequency of UTIs in 134 boys with antenatal hydronephrosis.[6] 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. ($P < .05$)

Concealed 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.[7] 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 applied 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 2 104 (29.8 %) boys with a concealed penis after circumcision and group 3 (control group) 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 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 reduction in 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.[8] 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 $\alpha/3$ 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. ($P = .032$) 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. ($P = .019$) There was no significant difference in number of patients having febrile UTI attacks after circumcision between two groups. All febrile UTI attacks 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, it required intervention and detailed laboratory examination revealed deficiency of factor 7. After the replacement of factor 7, no persistant 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.[9] Most authors agree on circumcision if the benefits outweigh the risks.[10] 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, meatal ulceration, glans necrosis and penil amputation whereas long term complications are urethral fistula and meatal stenosis.[11–13] 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 D et al conducted a study including 100 patients comparing ketamine+midazolam to sevoflurane+propofol in terms of surgical site hemorrhage in circumcision.[14] They found that the intraoperative bleeding scores were significantly higher in ketamine+midazolam 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 after 24 hours, after making sure that there is no bleeding or oozing. Gently washing the wound for 5-7 days helps prevent postoperative wound infections. 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 period 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 psychological way due to undergoing a surgery associated with their sex organ. School aged boys may need sedation anesthesia in addition to dorsal penile nerve block during the procedure.[16] Boys in peripubertal period may have tearing of sutures before healing is complete due to intermittant 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 covered 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 circumcision, 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 circumcision. 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 limitation of our study because there is no widely accepted definition of concealed penis in the literature.

Most authors agree on that concealed penis would not be regarded as a complication of circumcision, 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 penis after circumcision generally do not have balanoposthitis 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 bacterial 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 circumcision. 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 reported for healthy group, as concealed had significantly higher number of febrile urinary tract infections. We think there is a direct correlation between the increased 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 uropathogenic 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 results. These limitations would diminish the validity of the study results. However, we avoided a possible bias with the exclusion of post-circumcision scars and serious complications such as urethral 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 bacterial 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 population. 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.

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Conflict of Interest

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

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

Healthy Population With No Urinary Tract Abnormalities	**Group 1 Circumcised Boys Without Concealed Penis**	**Group 2 Concealed Penis After Circumcision**	**Group 3 Uncircumcised**	**Total**	***P* Value Analysis Of Three Groups**
Mean Age (Years)	6.12 ± 0.7	6.15 ± 0.6	6.36 ± 0.8	6.2 ± 0.7	.15
Number Of Patients	144 (41.3 %)	104 (29.8 %)	100 (28.7 %)	348	.048
Percentage Of Positive Uropathogenic Culture In Periurethral Meatal Area	29.6 %	62.6 %	68.9 %	50.7 %	.026
Percentage Of Positive Uropathogenic Culture In Glanular Sulcus	43.8 %	69.2 %	77.4 %	61.0 %	.039
Percentage Of Positive Uropathogenic Culture In Any Area	45.2 %	73.4 %	82.9 %	64.4 %	.032
***P* Value For Periurethral Meatal Culture**	Group 2 p = .008 Group 3 p = .004	Group 1 p = .008 Group 3 p = .11	Group 1 p = .004 Group 2 p = .11	-	-
***P* Value For Glanular Sulcus Culture**	Group 2 p = .011 Group 3 p = .009	Group 1 p = .011 Group 3 p = .097	Group 1 p = .009 Group 2 p = .097	-	-
***P* Value For Any Culture**	Group 2 p = .009 Group 3 p = .007	Group 1 p = .009 Group 3 p = .081	Group 1 p = .007 Group 2 p = .081	-	-

P values refer to ANOVA analysis, *P* values refer to post hoc analysis. Bonferroni test was used for post hoc analysis.

Table 2: Number of febrile UTI attacks in two groups.

Non-healthy Population With Urinary Tract Abnormalities	**Concealed Penis After Circumcision**	**Non-concealed Penis After Circumcision**	**Total**	***P* Value**
Mean Age (Months)	28 ± 3.38	25.3 ± 3.0	26 ± 3.1	.076
Number Of Patients	31 (25 %)	92 (75 %)	123	.041
Number Of Febrile UTI Attacks	20	7	27	.019
Number Of Patients Who Had Febrile UTI After Circumcision	8	5	13	.069

Abbreviations: UTI, Urinary Tract Infection.

P values refer to student t test