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Does circumcision alter the periurethral uropathogenic bacterial flora

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ABSTRACT

Background: The aim of this study was to assess the pattern of periurethral bacterial flora in uncircumcised boys and to evaluate the effect of circumcision on alteration of periurethral uropathogenic bacterial flora. **Materials and Methods:** Pattern of periurethral bacterial flora before and after circumcision was studied prospectively in 124 boys. The results were analysed to compare change in bacterial colonisation before and after circumcision. **Results:** The age range was 6 weeks to 96 months. Most (94.3%) of the boys had religious indication and 5.7% had medical indication for circumcision. *E. coli*, Proteus and Klebsiella were most common periurethral bacterial flora in uncircumcised subjects. Coagulase-negative staphylococcus and *Staphylococcus aureus* was most common periurethral bacterial flora in circumcised subjects. In 66.1% of circumcised subjects, no bacteria were grown from periurethral region. **Conclusion:** We conclude that presence of prepuce is associated with great quantity of periurethral bacteria, greater likelihood of the presence of high concentration of uropathogens and high incidence of urinary tract infection (UTI). This study provides circumstantial evidence supporting the idea that early circumcision may be beneficial for prevention of UTI.

Key words: Circumcision, periurethral bacterial flora, uropathogen

INTRODUCTION

Circumcision is the removal of a simple fold of skin (The foreskin or prepuce) that covers the head (Glans) of unerected penis. Bacterial colonisation of prepuce is common in newborn but is infrequent after 5 years.[1] The organisms colonising the prepuce have been found to be the same with those which cause urinary tract infection (UTI) in young boys.[2,3] Such colonisation has been shown to occur before the UTI.[4] Once the foreskin has been colonised, these bacteria, especially the Enterobacteriaceae, could ascend the urinary tract through urethra producing cystitis, pyelonephritis, sepsis and/or septic deaths. Kashmir valley has a Muslim-dominated population where almost every Muslim boy undergoes circumcision, as made mandatory by religious basis. We undertook this study to evaluate whether by simple means of circumcision there will be any decrease in periurethral uropathogenic bacterial flora and there by subsequent UTI in boys who underwent circumcision for religious basis.

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MATERIALS AND METHODS

The present study was conducted at Sher-i-Kashmir Institute of Medical Sciences (Department of Paediatric Surgery in collaboration with Department of Microbiology) from May 2005 to May 2008. A total of 124 boys in the age range of 6 weeks to 96 months who underwent circumcision (94.3% for religious reasons and 5.7% for medical reasons) were studied prospectively. Patients who had hypospadias, epispadias and underlying urinary tract abnormalities were excluded from the study.

All patients before undergoing circumcision were subjected to routine urine investigations including complete blood count, bleeding time, clotting time and routine urine examination. Patients in whom urine examination reports pus cells >5/high power field were subjected to urinary culture. Culture report was considered positive if:

1. ≥100000 colony-forming units of specific uropathogenic bacteria/ml of urine cultured were observed, regardless whether UTI was symptomatic or asymptomatic.
2. 1000 to 10000 colony-forming units of specific uropathogenic bacteria/ml of urine cultured in patients who had symptomatic UTI.

At the time of circumcision, the foreskin was drawn back to expose Glans and specimen for culture was taken from the tip of Glans and coronal sulcus using a swab moistened with sterile saline. The swab was transported in Stuart's medium (transport medium) to microbiology laboratory. A part of it was placed on Blood Agar and MacConkey Agar (Solid media), rest was placed in Thioglycollate broth (back-up broth). The solid and liquid media were incubated overnight aerobically at 37°C. Growth on solid media were recorded and processed according to standard protocols. In case of no growth on solid media, subcultures were performed from Thioglycollate broth and incubated overnight aerobically at 37°C. The isolates were identified and growth recorded semi-quantitatively. Cultures which showed no growth after 48 hours were reported as sterile.

Following circumcision, the children were discharged home (same day in whom circumcision was done under local anaesthesia and next day in whom circumcision was done under general anaesthesia) with instruction to return for review at 3 weeks to outpatient department (OPD). None of the child received antibiotics during this period. At review in OPD, a second sample was taken from periurethral region and coronal sulcus for culture. This was processed in similar manner as before surgery. Similarly, routine urine examination/culture (depending upon report of microscopic examination report) was done at review. The results were statistically analysed to compare changes in bacterial colonisation and infection (UTI) before and after circumcision.

RESULTS

All these patients underwent circumcision for religious reasons. 58.9% were from urban area and 41.1% from rural area. Clinical features of our study group are given in Table 1. In our study, 8.06% of boys presented with clinical features of UTI. They were subjected to urine culture which grew bacteria in 60%. In 40%, urine culture was sterile. Out of bacteriologically proved UTI cases, 66.7% grew *E. coli* on urine culture and 33.3% grew Klebsiella. These patients were treated with antibiotics for 1 to 2 weeks and subjected to circumcision after their UTI got cured. At the time of circumcision in them, the periurethral swab culture taken grew bacteria consistent to the organism which has caused UTI earlier. At 3 weeks postoperatively, three of circumcised boys developed clinical features of UTI but none of them was bacteriologically proven by cultures [Table 2]. Periurethral swab culture preoperatively grew bacteria in 89.5% of the studied boys, whereas postoperatively only 33.9% of the boys grew bacteria. Most of the boys grew *E. coli* followed by Proteus preoperatively, whereas Coagulase-negative staphylococcus was the most common organism grown in postoperative period. None of our patients had *E. coli*, Klebsiella, Proteus, Pseudomonas, Enterococcus and Acinetobacter growth on postoperative periurethral cultures taken at 3 weeks after circumcision [Table 3].

Table 1: Clinical Features in our patients

Clinical features	No.	%
Uncircumcised penis	124	100
Phimosis	16	12.9
Paraphimosis	3	2.4
H/O balanoposthitis	4	3.2
Ballooning of prepuce	3	2.4
Poor urinary stream	3	2.4
H/O fever	3	2.4
Dysuria	4	3.2
Right inguinal hernia	27	21.8
Left inguinal hernia	11	8.9
Right hydrocoele	3	2.4
Left hydrocoele	8	6.5
Right undescended testis	8	6.5
Left undescended testis	3	2.4
Retractile testis	1	0.8

Table 2: Clinical *vs* bacteriologically proved UTI Pre- and Post-circumcision in studied patients

Clinical UTI	Pre-operative UTI	Post-operative UTI
No. of patients	10	3
% of total studied	8.06%	2.40%
Bacteriological proved	6	0
Sterile	4	3

UTI: Urinary tract infection

DISCUSSION

The proposed benefits of circumcision by various studies includes decreased incidence of UTI and UTI-related complications. Other benefits include decreased incidence of penile cancer, balanitis, posthitis, paraphimosis, heterosexually acquired acquired immunodeficiency syndrome virus infection in men, other sexually transmitted diseases and cervical cancer in female partners of circumcised men.[5-7]

It has been demonstrated that preputial sac act as reservoir of organisms and is thus responsible for causing ascending UTI.[8-10] Peak concentration of uropathogenic organisms around the prepuce occurs at the time of life at which UTI are most common in males.[10] Many studies have shown that the preputial

Table 3: Predominant periurethral bacterial flora in 124 studied subjects pre- and post-circumcision

	Pre operative periurethral bacterial flora		Post operative periurethral bacterial floral	
	Number	% of total studied	Number	% of total studied
No growth	13	10.5	82	66.1
E. coli	43	34.7	0	0
Klebsiella	16	12.9	0	0
Proteus	17	13.7	0	0
Pseudomonas	5	4	0	0
Enterococcus	3	2.4	0	0
Acinetobacter	2	1.6	0	0
Staphylococcus aureus	7	5.6	13	10.5
Mixed Gram+ Cocci Gram – Bacilli	3	2.4	0	0
Coagulase – Staphylococcus	15	12.1	29	23.4

sac is heavily colonised with *E. coli* and other gastrointestinal flora during first few years of life.[8,10-12] In present study, we also found *E. coli* as predominant organism. Bollgren and Winberg have shown that number of colonising bacteria that can be potential uropathogens decreases rapidly with the age and in children above age 5 years, virtually no Gram-negative organism was found in their study.[13] Present study is consistent with those of Bollgren and Winberg.[13]

Studies have suggested that in absence of congenital urinary tract anomalies, most UTIs occur in uncircumcised boy.[14] It has been established that UTIs in children are usually ascending rather than blood born.[4,11] The bacteria present in the periurethral region are usually responsible for these infections.[13,15] Infections of urinary tract are regarded as being common in paediatric population, with higher prevalence and greater severity of UTIs prior to 6 months of age. It is only at this period of life incidence of UTIs is greater in males than females.[16,17] Neonatal circumcision has shown to be associated with 10- to 20-fold decrease in UTIs in male infants.[17] As reported by Craig *et al.*,[18] their study found that 6% of uncircumcised boys developed UTI while only one percent of circumcised boys developed UTI. In present series, UTI was found in 8.06% of uncircumcised boys and 2.4% of circumcised boys. Similar results were obtained by others.

Gunsar *et al.*[19] studied the effect of circumcision on periurethral and glanular flora in 50 patients who underwent circumcision for socio-religious reasons and found pathogenic bacteria in periurethral region of 64% of patients before circumcision and this number decreased to 10% after circumcision. Similarly, pathogenic bacteria were cultured from glanular sulcus swabs of 68% of patients as compared to 8% following circumcision. Our study is comparable with the preoperative periurethral and periglanular bacterial frequency of Gunsar *et al.*[19]

Balat *et al.*,[20] in their study, found increased number of Langerhans cells in prepucium, while only a few CD4 T lymphocytes were observed around perivascular area and no expression of CD8 was observed in prepucium. They concluded that the increase in Langerhans cells in prepucial skin may be the result of continuous stimulation of bacteria found in periurethral area and the absence of CD8 may help the colonisation of uropathogenic bacteria. We conclude that presence of prepuce is associated with great quantity of periurethral bacteria, greater likelihood for presence of high concentration of uropathogens, especially in first 12 months of life and high incidence of UTI. We postulate that circumcision converts a cul-de-sac that is reservoir of uropathogenic organisms into a surface colonised by natural skin organisms (commensals). Present study provides circumstantial evidence supporting the idea that early circumcision may be beneficial for prevention of UTI.

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