THE EFFECT OF PREPUTIAL FLORA TO URINARY TRACT INFECTIONS IN UNCIRCUMCISED BOYS

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SUMMARY :

Purpose: *The periurethral region of uncircumcised young infants may be a criticial site of colonization by bacteria and may provide optimum conditions for attachment and ascension of these bacteria. We performed this investigation to determine the effect of preputial flora to urinary tract infections in uncircumcised boys.* ***Methods:*** *Eighty-two boys who applied with symptomatic urinary tract infection and 166 boys with other causes were included in this study. Urine samples and preputial swab samples were obtained from all boys and they were cultured on the brain-heart infusion and methylen blue agar media plates. All the plates were reviewed by the same microbiologist. Data were evaluated for significance with chi-square analysis.* ***Results:*** *Between the symptomatic and control groups, there was no relation with respect to the types of isolated bacteria and total aerobic colony counts in the preputial swab samples ($p>0.05$). In the 12 months and younger age group, the co-existence rates in urine samples and preputial swabs of Escherichiae species and Enterobacter species were significantly higher in the urinary tract infection group compared to the control group ($p<0.05$). In 1 to 3 years of age and older groups, there was not a correlation between the urine samples and preputial swabs with respect to the type of isolated bacteria ($p>0.05$).* ***Conclusion:*** *We concluded that if circumcision is considered, it should be performed in the neonatal period in order to prevent urinary tract infection and its potential complications. It can also be concluded that the circumcision may be offered to boys who have urinary infection history under 1 year of age.*

Key Words: *Urinary Tract Infections, Circumcision, Bacteria, Urethra.*

INTRODUCTION

Circumcision is one of the oldest operations known. The Egyptians depicted circumcision in bas-relief on the tombs of Ankh-Mahor in ancient Egypt. Ritual circumcision has been practiced by Jews through the centuries and it is also practiced by Muslims and many other groups in different parts of the world.

Circumcision is the most common operation performed in males in the United States.1,2 Fourty-eight per cent of males are circumcised in Canada and 24 % in the United Kingdom (3). Nevertheless, the routine removal of the foreskin has been a controversial issue (2, 4). There are many authors who believe uncircumcised boys are at an increased risk for urinary tract infections (UTIs) during infancy (5-8). Wiswell and colleagues reported a 10-

20 fold increased risk for UTIs during the first year of life in uncircumcised, compared with circumcised boys (1-3). Ginsburg and Mc Cracken reviewed data on 109 infants between the age of 5 days and 8 months who had experienced UTIs. They found that there was male predominance in the infected group and 95 % of the boys with UTIs were uncircumcised (4). Herzog similarly observed a higher incidence of UTIs among uncircumcised boys in an outpatient setting (9). But some authors have suggested that there are no plausible physiologic explanations for the association between UTIs and the noncircumcision state (10,11).

The pathogenesis of UTIs involves an interaction between bacterial factors, local protective host factors and the density and distribution of the epithelial cell receptor molecules along the urinary tract (12). The periurethral region of uncircumcised young infants may be a criticial site of colonization by bacteria, predominantly gastrointestinal flora, and may provide optimum conditions for attachment and ascension of these bacteria (13). Fussel et al. showed that the mucosal surface of foreskin was colonized readily by pathogenic Escherichiae coli, fimbriated strains of Proteus mirabilis and nonfimbriated Pseudomonas, Klebsiella and Serratia. They reported that the bacteria had not adhered to keratinized surface of the foreskin, and once the bacteria were attached and colonized the tissue near the urethra, they could ascend the urethra to produce UTI (14).

We performed this study to determine the etiologic agent of UTI in uncircumcised boys and to investigate the existence of this agent in the inner surface of the preputium.

PATIENTS AND METHODS

During the period of February 1 and June 30, 1996, in Sivas Hospital for Children and in the Department of Urology of University Hospital, 82 boys who applied with symptomatic UTI and 166 boys who applied with other causes were included in this study. All the boys' relatives were informed about the procedure. The prepuce was gently retracted and preputial swab (PS) samples were obtained by using sterile calcium alginate swab. The PS samples were immediately cultured on brain-heart infussion and methylen blue agar media plates. Then the prepuce was gently retracted to expose the meatus and glans penis was washed with soapy water. In boys, the midstream urine samples were obtained during micturation; in young infants urine samples were obtained by using the sterilised tubes attached the glans penis. Unfortunately, we could not obtain urine samples by suprapubic aspiration because of intoleration of patients' relatives for this procedure. The urine samples were cultured on the same media plates. All the plates were reviewed by the same microbiologist. Data were evaluated for significance with chi-square analysis.

RESULTS

The mean age of the 248 uncircumcised boys included in this study was 31.6 months (range between 2 months and 7 years). The mean age of the 82 boys with UTI was 36.3 months (7 months-6 years). The bacteria were isolated in both urine and PS samples of the 65 boys in the latter group the (79.3 %). Fourty-four of these 65 samples revealed the same bacteria in both urine and PS. The isolated bacteria were different in 21 cases in the urine and PS samples (32.3 %). Seventeen boys with bacteria isolated in the urine did not have the same pathogenical bacteria in the PS samples. In these boys, all urine samples revealed 10 or more colony forming units (CFU) bacteria, while in PS the CFU counts were $\leq 10^3$. The mean count of bacteria isolated from PS samples was 2.03. In 8 urine samples, the type of isolated bacteria was greater than one. In this group the most frequently isolated bacteria were Escherichia species (spp) in urine and Staphylococcus spp in PS samples.

In the control group the mean age was 34.4 months (range between 2 months and 7 years). For 39 of these boys, no bacteria were isolated in either urine or PS. In 29 urine and PS samples the bacteria isolated $\leq 10^3$ CFU. No bacteria were isolated in urine and 10^3 or less bacteria were isolated in PS in 98 cases (Table 1).

There was not a significant correlation with respect to the type of bacteria and CFU counts in PS samples. The most frequently isolated bacteria was Staph. spp in both the infected and control groups. In 40 % of cases, whose urine samples were infected with Escherichiae spp, the same bacteria was isolated in PS samples. The frequency rates of Staph. spp, Enterobacter, Enterococ and Proteus spp in PS were higher than in urine.

Table 1 : The bacteria isolated from urine and PS samples in the patient and control groups.

	Patient group				Control group			
Bacteria	**Urine**	**%**	**PS**	**%**	**Urine**	**%**	**PS**	**%**
Escherichiae spp	52	63.4	21	25.6	5	3.0	30	18.0
Staphylococcus spp	15.	18.3	38	46.3	14	8.4	96	57.8
Enterobacter spp	11	13.4	21	25.6	5	3.0	31	18.7
Enterococcus spp	6	7.3	16	19.5	6	3.6	29	17.5
Proteus spp	1	1.2	4	4.9	0	0	18	10.8
Pseudomonas spp	1	1.2	0	0	0	0	2	1.2

As the boys were grouped according to their ages, in the 12 months and younger age group, the co-existence rates in both urine and PS samples of Escherichiae spp and Enterobacter spp were significantly higher in the UTI group compared to the control group ($p<0.05$). This peculiarity was not present for Staph. spp and Enterococcus spp ($p>0.05$). In this age group, all PS samples obtained from the boys with UTI revealed bacteria. But in the control group, 5 boys, urine and PS samples were infected. In 13 boys, PS and urine samples revealed the same bacteria or the bacteria isolated from urine existed among the bacteria isolated from PS samples (Fig. 1). In this age group, Escherichiae spp and Enterobacter spp. isolated in PS were predisposing for UTIs.

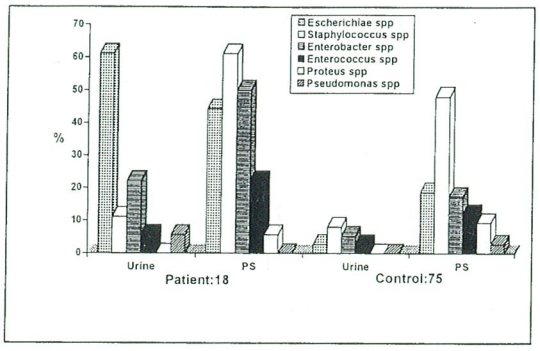

Fig. 1 : The types of bacteria isolated from the urine and PS in the 12 months and younger age group.

In the 1-3 years of age group, 27 boys with UTI and 49 control boys were present. In the infected group, no bacteria were isolated in PS samples of 11 boys and different bacteria were isolated in urine and PS samples of 9 boys. In 8 of the urine samples and 42 of the PS samples in the control group 10^3 or less CFU counts of bacteria were isolated (Fig. 2). In this age group, the preputial flora seemed to have no effect on UTI pathogenesis.

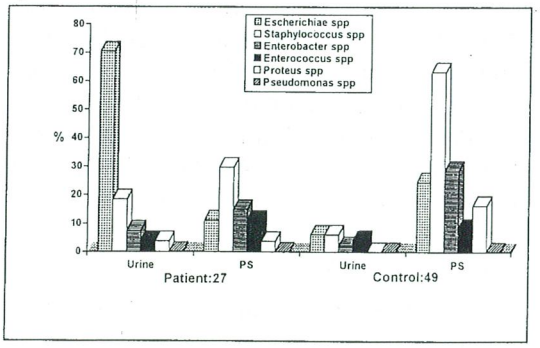

Fig. 2 : The types of bacteria isolated from urine and PS in 1-3 years of age group.

In 84 % of boys with UTIs and 79 % of control boys in 3 years and older age group, bacteria were isolated from the PS samples. The presence of Escherichia spp in PS in boys infected with Escherichia spp was significantly higher compared to controls ($p<0.05$). The types of bacteria isolated from urine and PS in this group are shown in figure 3. In this age group of control cases, 10^3 or less bacteria were isolated in 7 urine samples and 33 PS samples.

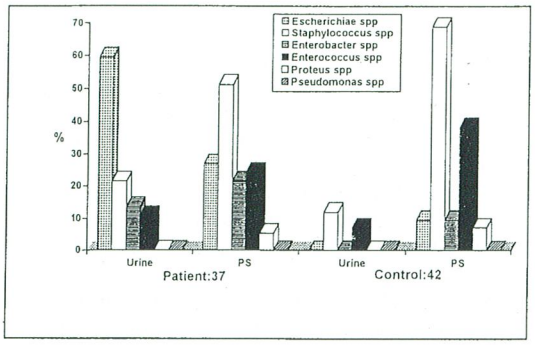

Fig. 3 : The types of bacteria isolated from urine and PS in the 3 years and older age group.

DISCUSSION

The human foreskin is a thin layer of skin that folds down over the glans penis. This layer consists of stratified squamous epithelium and underlying dermis (14). Smegma is thought to represent the debris of desquamated epithelial cells that originate from epithelial prominence on the glans penis and on the inner surface of the foreskin. Biochemical analysis of human smegma shows that it is composed of 26 % fat and 13 % protein, figures consistent with necrotic epithelial debris. Moreover, it is proposed that the effect of Mycobacterium smegmatis present in the preputial sac of 50 % of men results in degradation of smegma into potent proximate carcinogens such as hydrocarbons or steroids (15).

At birth, the prepuce is retractable in only 4 % of boys. In almost half of newborn boys, it cannot be retracted sufficiently over to permit visualization of the external meatus. By 6 months of age, the prepuce can be completely retracted in only 20 % of boys and by 3 years of age 10 % of boys still have unretractable foreskin as a harbor for uropathogenic bacteria. UTI is most frequently seen at neonatal period in all the life span of males (5-7).

UTIs are common bacterial diseases during infancy, the adverse sequelae of which are well known (8,15-17). Uncircumcised boys are at a high risk for these infections (5-8). Fussel et al. hypothesized that circumcision might prevent urinary tract infection by removing the substrate for adhesion and colonization by pathogenic bacteria (14). According to Wiswell and associates, as uncircumcised boys get older, the foreskin would become more retractable, allowing improved penile hygiene and potentially decreased bacterial exposure (1-3,18). In 1985, they reported a 20-fold increased risk for UTI during the first year of life in uncircumcised, compared to the incidence of UTIs in a population of more than 200.000 males who had been born in US Army hospitals over a 10 year period. Foreskin intact boys were 10 times (1,4% compared to 0,14%) more likely to develop UTI (1, 2-18).

Bollgren and Winberg studied the periurethral flora of healthy girls and uncircumcised boys from birth to 16 years and they reported massive bacteria present in boys during early infancy, predominantly E.coli. In this study, the number of bacteria decreased substantially in later infancy (16). Wiswell and colleaques' investigation supports the role of the prepuce in harboring E.Coli. They found the periurethral flora of uncircumcised boys <6 months of age to be substantially different from that of circumcised boys and there is a greater likelihood for the presence of uropathogens (18). Recently, Bennett et al. evaluated the relationship between epididymitis and circumcision status and they concluded that the foreskin is a potent etiological factor in prepubertal and postpubertal boys with epididymitis (19). All 5 infants in their study who had acute epididymitis were uncircumcised and they did not have any underlying genitourinary abnormality.

Burbige et al. examined the type of bacteria in urine and they found a large proportion of gram-positive organism (49 %) in boys with UTI while E.Coli accounted for only 21% of the infections. They reported that the presence of a foreskin did not seem to alter the culture results in favor of gram-positive organisms, the hematogenous route being more important in boys (20). In our study, we observed that the predominant bacteria was Staph. spp. in the PS samples of all UTI groups and control groups, and E.Coli in urine samples obtained from all age groups of boys with UTI. As we compared the preputial colonization of bacteria according to age groups, in the 1 year and younger age group the isolation frequency of E.Coli was significantly higher than the control group ($p<0.05$). This indicates that E.Coli colonized in the preputium inner surface may be predisposing for UTI in 1 year

and younger age boys. In 1-3 years age group, isolation frequency of this bacteria in PS samples was lower in boys with UTI than those in the control group. This results indicates that the preputial flora does not augment the risk of UTI in 1-3 years aged boys. In the 3 years and older age group, the frequency of E.Coli isolation from PS samples was significantly higher than the control group ($p<0.05$). Although the frequency of Staph.spp. in the control group was higher than the UTI group, the frequency of Staph.spp. in urine samples was one third of E.Coli frequency. Therefore, a correlation was not observed between the preputial flora and UTI in this age group.

The American Academy of Pediatrics (AAP) has declared "There is no absolute medical indication for routine circumcision of the newborn" (21). In 1989, the AAP published an updated report on the issue of whether to perform circumcision in the newborn. This report reviews penile hygiene, cancer of the penis, UTI, sexually transmitted disease, cervical carcinoms, pain, local anesthesia, contraindications, and complications. They concluded that newborn circumcision has potential medical benefits and advantages, as well as disadvantages and risks. When circumcision is being considered, the benefits and risks should be explained to the parents and informed consents obtained (22).

In our study, the observation of probable E.Coli responsibility in UTI pathogenesis in boys under 1 year of age suggests that if circumcision is being considered it must be performed in the neonatal period. We believe that this approach will be preventive for UTI and its potential complications. It can also be concluded the circumcision may be offered to boys who have urinary infection history under 1 year of age.

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