

## Preputial Condition and Urinary Tract Infections

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*Recently, an increase in incidences of urinary tract infections in uncircumcised male infants has been reported. However, determining what is the best management for the prepuce of newborns and infants is still to be solved. I investigated prospectively how much foreskins are retracted with age and what correlations it has with urinary tract infection in 122 males children below 15 years of age. Under 6 months of age, the majority of the foreskins were unretractable. As they got older, over 3 years of age, their prepuces became retractable. The incidence of bacteriuria was 11.4% in uncircumcised but none in circumcised and hypospadias. In 8 patients showing bacteriuria, their foreskins were retracted below 25% in length. Among them, 5 patients, in whom E. coli were grown in their urine, showed radiologic renal abnormalities and suffered from high fever indicating systemic infection. However, the other 3 cases infected by Proteus mirabilis in their urine complained of only local penile symptoms.*

**Key Words:** Prepuce, Urinary tract infection, Male children

### INTRODUCTION

It has been known that the uncircumcised prepuces may be a soil for easier bacterial colonization and cause frequent urinary tract infections in children. Ginsburg and McCracken(1982) reported that 95% of the infants with urinary tract infections(UTI) were uncircumcised. However, there are still controversies about neonatal circumcision. So, the objective of this study is to investigate prospectively, to what extent foreskins are better to be retracted over the glans with age, what correlations they have with urinary tract infections, and what correlations there are between micro-organisms and associated urologic problems.

### MATERIALS AND METHODS

The condition of the foreskin was checked in 122

children(below 15 years of age) who visited our in-patient and out-patient clinic, including 21 children already circumcised and 4 children with hypospadias. Their chief complaints were of systemic infectious symptoms such as high fever and local urologic problems such as cryptorchidism, hydrocele, enuresis, etc.

The patients were divided into 4 groups according to the degree of preputial retraction(below 25%, - 50%, - 75%, and - 100%). Urine cultures were done in 92 patients. Urine was collected in a urine 'bag' collector (Dai You Chemical, Korea) for infants and a urine bottle for older children. Significant bacteriuria was defined as more than  $10^5$  colonies/ml of urine. Radiologic studies were performed only for the patients who revealed systemic infection.

### RESULTS

Among the 19 patients under 6 months of age, the foreskins were retracted below 25% in 17(89.5%) cases and over 75% only in 2(10.5%) cases. Complete retraction(over 75%) occurred in all cases up to 10 years of age(Table 1). Preputial retraction occurred progressively with age(Fig. 1).

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**Table 1.** Retraction rate of the prepuce according to age.

Age	Preputial retraction (%)			
	-25%	-50%	-75%	-100%
6 mons.	17(89.5)	0	0	2( 10.5)
3.5 yrs.	24(50.0)	8(16.7)	1(2.1)	15( 32.1)
6.5 yrs.	3(18.7)	1( 6.2)	1(6.2)	11( 68.8)
9.5 yrs.	1(11.1)	1(11.1)	0	7( 77.8)
12.5 yrs.	0	0	0	4(100.0)
15.5 yrs.	0	0	0	1(100.0)
	45(46.4)	10(10.3)	2(2.1)	40( 41.2)

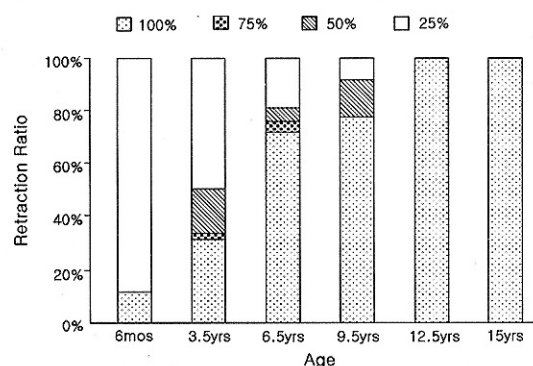
**Table 2.** Incidence of significant bacteriuria

Patient No.	*Bacteriuria No. (%)	
Uncircumcised	70	8(11.4)
Circumcised	19	0
Neonatal	12	
Older age	7	
Hypospadias	3	0
Total	92	8(8.7)

\*Bacteriuria : over  $10^5$  colonies/ml of urine

**Table 3.** Infecting microorganisms and associated urologic problems.

Organisms	Patients		
	Age	Preputial retraction	Associated problems
<i>Proteus mirabilis</i>	8 mons	below 25%	Hydrocele, Smegma
	2.5 yrs	below 25%	Concealed penis, Dysuria
	5.5 yrs	below 25%	Balanoposthitis
<i>E. coli</i>	1 mon	below 25%	Fever, Renal pelvis mass
	1 mon	below 25%	Fever, Hydronephrosis
	1 mon	below 25%	Fever, Hydronephrosis
	8 mons	below 25%	Fever, Hydronephrosis
	16 mons	below 25%	Fever, Hydronephrosis

**Fig. 1.** Preputial retraction ratio increases progressively with age

The incidence of bacteriuria was 8.7%(8/92) in all patients and 11.4%(8/70) in the uncircumcised. However, there was no bacteriuria in the circumcised and in patients with hypospadias (Table 2).

In the 8 patients showing significant bacteriuria, prepuces were retracted below 25% in all cases. Their ages were below 1.3 years and 3 of them were newborns. The micro-organisms identified were *Proteus mirabilis* in 3 patients and *E. coli* in 5 patients. All patients infected with *Proteus mirabilis* complained of only local penile problems such as dysuria, pain in the glans, and smegma under the prepuce. However, all patients infected with *E. coli* suffered from systemic infections with high fever and renal abnormalities were identified in radiologic studies (Table 3).

## DISCUSSION

The presence of an unretractable prepuce may facilitate colonization by uropathogenic bacteria and promote the adherence of bacteria. As a result, these factors may play important roles in the pathogenesis of UTIs (Ginsburg and McCracken, 1982; Roberts, 1986; Wiswell et al., 1988; Wiswell, 1992).

Among 5,261 infants, 41(0.78%) had confirmed UTI in the first year of life. UTI occurred in only 0.47% of female and 0.21% of circumcised male infants, while it occurred in 4.12% of uncircumcised male infants (Wiswell et al., 1985). According to other reports, the incidence of UTIs is generally 5-89 folds higher in the uncircumcised than in the circumcised (Wiswell et al., 1987; Lohr, 1989; Wiswell and Hachey, 1993). In association with the methods of urine collection, positive urine cultures in 'bag' urine and voided urine are not always correlated with those in suprapubic aspiration urine (Gower et al., 1970; Edelman et al., 1973; Davies et al., 1974). Positive culture rate is known ten times higher in urine collected in a urine "bag" than by suprapubic aspiration (Wettergren et al., 1985; Herzog, 1989). However, when bacterial culture is negative in urine collected in a bag, it has diagnostic value for ruling out of UTI (Edelmann et al., 1973; Davies et al., 1974).

The concentrations of periurethral aerobic organisms decrease with increasing age (Bollgren and Winberg, 1976). The rate of bag positive culture and the infection rate in males had actually decreased six to nine months after birth. There are no general differences in incidence of infection between circumcised and uncircumcised boys after 12 months of age. In other words, the pres-

ence of the prepuce is a highly significant risk factor for UTI in infants up to 12 months of age (Wettergren et al., 1985; Wiswell et al., 1988; Herzog, 1989; Wiswell, 1992). This is true regardless of races and socioeconomic groups (Herzog, 1989).

The prepuces are fused with the epithelium of the glans when they are formed in intrauterine life. At birth, their separation is incomplete and continues through childhood. The prepuce is retractable only in 4% of boys at birth and the external urethral meatuses are visible in 50% of newborn babies. Complete preputial retraction occurs only in 20% by 6 months and the prepuces are retracted completely in most boys by 17 years (Gairdner, 1949; Oster, 1968; Duckett, 1988). These results indicate that easier retraction of the prepuce with increasing age may cause improved foreskin hygiene and decrease the colonization of periurethral aerobic flora (Wettergren et al., 1985).

The main pathogen of the urinary tract is *E. coli* in boys and girls without difference (Bahna and Torp, 1975; Herzog, 1989). *E. coli* with fimbriae (pili) will bind to the mucosal surface of the prepuce but not to the outer skin surface (Fussell et al., 1988).

The incidence of obstructive abnormalities in the boys with UTI was reported to be only 7% (Ginsburg and McCracken, 1982) but urologic abnormalities requiring prolonged medical follow-up were in one fourth of infected infants (Herzog, 1989). Recurrent UTIs occur in one fourth of infected infants and almost during first three months of life. Renal scarring develops greatest in infections during infancy and these infections in the first 3 years of life are the only etiologic factors leading to significant renal scars (Bergström et al., 1972; Roberts, 1986).

In conclusion, it is thought that preputial retractions over the glans increase progressively with increasing age and the presence of the unretractable foreskin promotes urinary tract infection. In uncircumcised males, attention should be paid especially to newborns and young infants. In this study, all patients infected with *E. coli* suffered from systemic infection and had renal abnormalities. This is one of the interesting things although the number of cases is small.

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