

# Comparison of uroflow parameters before and after hypospadias surgery

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**Aim** Uroflow investigation is used to identify whether stenosis has developed in the constituted neourethra after hypospadias repair. It is not clear whether a functional partial stenosis in the urethra in hypospadias cases is related to surgery or is present before the surgery. We aimed to investigate whether the obstructive pattern found in the urethra was related to the surgery or was present previously by performing a uroflow investigation before and after surgery in children operated for hypospadias and also in children with normal urethra as a control group in this study.

**Materials and methods** A total of 47 pediatric cases operated on and followed up with a diagnosis of hypospadias at the Ankara Child Health and Diseases, Hematology Oncology Training and Research Hospital's Pediatric Surgery Clinic between January 2010 and June 2013 and a control group of 32 healthy children without symptoms of hypospadias or other urinary system problems were included in the study. Uroflowmetric investigations (maximum urine flow rate, mean urine flow rate, urination amount, urination duration, duration of reaching maximum speed) of the cases before and after surgery and uroflowmetric investigation of the control group together with the residual urine amount as examined by ultrasonography were compared. We evaluated 47 pediatric hypospadias cases in terms of age at surgery, meatus localization, type of surgery, and number of surgeries.

**Results** The mean age was 6.1 years for the patients operated with a diagnosis of hypospadias and 7.78 years for the control group. The most common uroflow flow curve

in the preoperative study group and the control group was bell-type flow (57.4 and 43.8%). Bell-type flow was again most common postoperatively, but there was a significant decrease in plateau-type flow. Comparison of the uroflowmetry measurements of the hypospadias and control groups showed that the preoperative flow rates were low and some cases had residual urine in the bladder in the first group. When the postoperative measurements were used for the comparison, a significant difference was observed between the hypospadias and control groups in the flow rate and residual urine amount, whereas there was no difference compared with the preoperative evaluation. No significant relationship was found between the type of surgery used and uroflowmeter evaluations in our study.

**Conclusion** We found that the urination dynamics and partial urethral obstruction of hypospadias cases were present from the beginning and did not improve with surgery. *Ann Pediatr Surg* 14:27–30 © 2018 Annals of Pediatric Surgery.

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## Introduction and aim

Hypospadias is one of the most common congenital abnormalities of the male genital tract. The word hypospadias is derived from the words 'hypo' (down) and 'spadon' (split, hole) in Latin.

The urethra opens to a region more proximal to the end portion of the glans penis than normal in these cases. The incidence is 1 in 300 liveborn boys [1–3]. Hypospadias can be classified as glanular, distal, and proximal according to the site of the urethral opening. Approximately 70–80% of all cases consist of distal-type hypospadias [4].

Difficulty in urination because of meatal stenosis can be present in hypospadias patients before surgery. The partial obstruction findings found in the postoperative uroflow investigation are believed to be related to the stenosis in the new urethra because of the surgical procedure [5–11].

We evaluated 47 pediatric patients operated on in our clinic for hypospadias between January 2010 and June 2013 and then followed up together with 32 healthy children who did not have hypospadias or any other

systemic symptom in our study. We aimed to determine whether there was a change in the uroflowmetry results of hypospadias patients between preoperative and postoperative periods or a difference from the control group by a statistical evaluation.

## Materials and methods

A total of 47 pediatric cases who were operated on for hypospadias at our Pediatric Surgery Clinic between January 2010 and June 2013 and followed up together with 32 healthy children with no hypospadias or other systemic symptoms were included in this study. Approval was obtained from the Ankara Child Health and Diseases, Hematology Oncology Training and Research Hospital's Clinical Research Ethics Committee.

All children included in the study were older than 3 years of age and had received potty training. The cases were divided into three groups: 47 pediatric hypospadias cases who had not undergone surgery (group 1, preoperative group); 47 pediatric hypospadias cases who had undergone surgery a minimum of 3 months ago (group 2,

postoperative group); and 32 healthy children cases (group 3, control group).

The 47 cases diagnosed with hypospadias were evaluated in terms of age of surgery, meatus localization, type of surgery performed, number of surgeries, hospitalization duration, and complications. The 32 child cases in the control group were evaluated to compare them with the preoperative and postoperative groups in terms of age and uroflowmetry results.

The groups were compared for uroflowmetric values (maximum urine flow rate, mean urine flow rate, urination amount, urination duration, duration of reaching maximum speed) and also the residual urine amount examined with ultrasonography.

The uroflowmetric parameters investigated were the maximum urine flow rate, the mean urine flow rate, urination amount, urination duration, duration of reaching maximum speed, and flow curve classification. The flow curve classification accepted by the International Child Continence Society was used for the evaluation of uroflowmetry results. Residual urine amount in the bladder for each child was measured with ultrasonography after urination.

Expected bladder capacity (EBC) was calculated using the formula  $[\text{age (year)} + 1] \times 30$  as recommended by the International Children's Continence Society.

The maximum bladder capacity was compared with the EBC. Residual urine of 20 ml or more was considered pathological.

As recommended by the International Children's Continence Society, we accepted a maximum urination volume of less than 65% of EBC as low bladder capacity and more than 150% as high bladder capacity.

A maximum urine flow rate less than 10 ml/s was considered low. Plateau, staccato, and discontinuous urination curves were considered pathological.

The SPSS 17.0 program was used for the analysis. We used the *t*-test and, if necessary, the Mann-Whitney test for paired group comparison of constant variables, the One-way analysis of variance (ANOVA) or the Kruskal-Wallis test, which is its nonparametric equivalent, for three-way group comparisons, and the  $\chi^2$ -test for group comparisons of discrete variables.

A *P* value less than 0.05 was considered statistically significant.

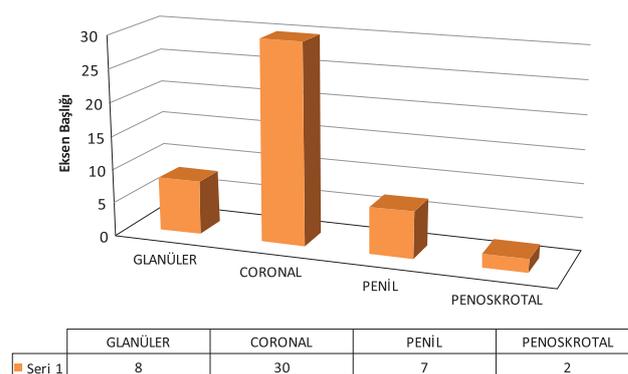
## Results

The mean age was 6.1 years for the 47 cases operated for hypospadias in our study and 7.78 years for the 32 children in the control group. No marked stenosis was observed in the external urethral meatus of any case on preoperative examination.

Figure 1 presents the distribution of the hypospadias types of our cases according to the Barcat classification.

We also evaluated our cases according to the type of surgery performed. Figure 2 presents the type of surgery

Fig. 1



The distribution of hypospadias types according to the Barcat classification.

with the meatus localization. The mean hospitalization duration was 5.67 days.

The complications that developed during follow-up were urethrocutaneous fistula in six (12.7%) cases, meatal stenosis in four (8.5%) cases, and diverticulum in one (2.1%) case. Among the fistula cases, three had undergone primary fistula repair and the other three had undergone repair with a re-Snodgrass procedure.

The 47 cases diagnosed with hypospadias were investigated in terms of preoperative and postoperative uroflowmetry results and residual urine. These results were compared with the uroflowmetry results of the control group that included 32 healthy children. Uroflowmetry findings of the cases are shown in Table 1.

Although a statistically significant difference was present between the groups in terms of the maximum urine flow rate, mean urine flow rate, and residual urine ( $P < 0.05$ ), no such difference was present for the duration of reaching the maximum rate, urination amount, and urination duration (one-way ANOVA test).

Preoperative and postoperative residual urine amounts in our cases operated for hypospadias were higher than those of the control group.

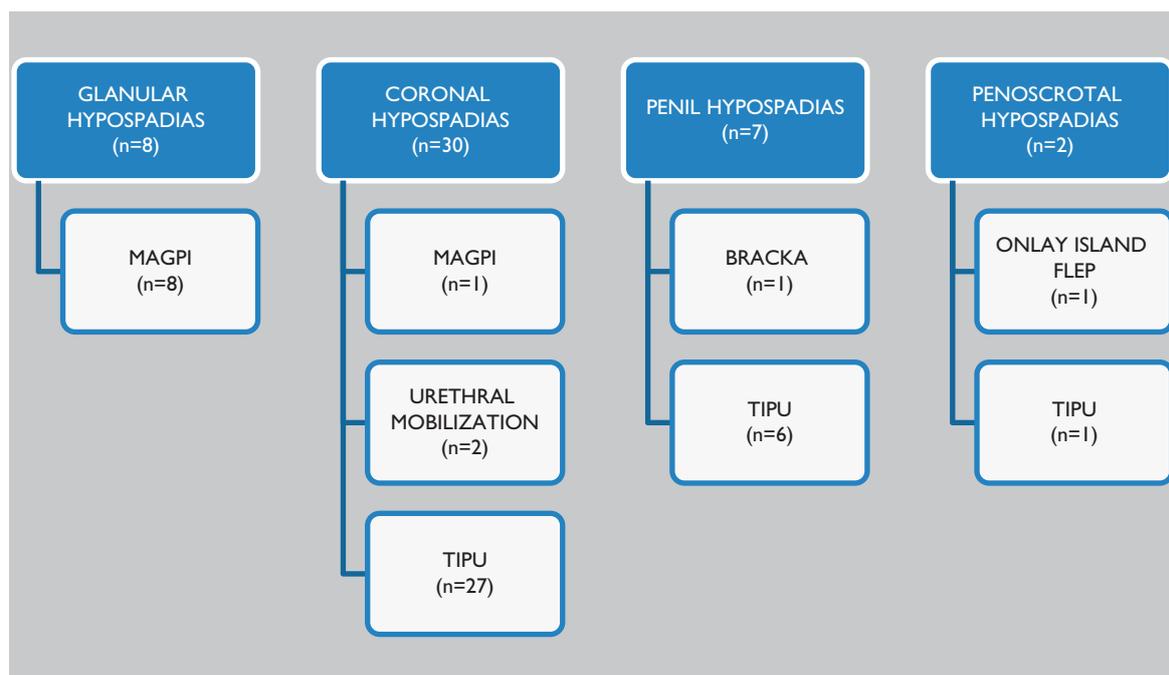
The urine flow curves of the patients were also evaluated and the results are presented in Table 2.

Uroflowmetry findings were assessed according to the localization of the meatus. The mean urination amount was 169 ml in cases with a glandular localization, 183 ml with a coronal localization, 298 ml with a penile localization, and 178 ml with a penoscrotal localization.

Although no statistically significant association was present between the meatus localization and the maximum urine flow rate, the mean urine flow rate, duration of reaching the maximum speed, urination duration, and residual urine, such an association was found with the urination amount ( $P < 0.005$ ) (one-way ANOVA).

No statistically significant difference was present between the urine flow curves according to meatus localization, but a statistical difference was present between the meatus

Fig. 2



The distribution of hypospadias types according to the Barcat classification.

Table 1 Mean uroflowmetry values

Uroflowmetric values	Preoperative	Postoperative	Follow-up
Maximum urine flow rate (ml/s)	11.5	13.3	19.2
Mean urine flow rate (ml/s)	7.9	9.1	10.2
Urination amount (ml)	186	209	223
Urination duration (s)	28.7 16 (+10)	21.63	22.5
Duration of reaching maximum speed (s)	11.6	9.6	9.4
Residual urine (ml)	28.7	27.8	6

Table 2 Urine flow curves

Urine flow curve	n (%)		
	Preoperative group	Postoperative group	Control group
Bell	27 (57.4)	34 (72.3)	14 (43.8)
Plateau	14 (29.8)	7 (14.9)	10 (31.2)
Interrupted	2 (4.3)	0	4 (12.5)
Staccato	4 (8.5)	6 (12.8)	4 (12.5)

localization and the bladder capacity by age according to the amount urinated ( $P < 0.05$ ) ( $\chi^2$ -test).

No statistical association was found between the presence of complications and the complication type with meatus localization ( $\chi^2$ -test).

The relationship between the type of surgery used and the postoperative uroflowmetry results was also investigated. No statistical association was found between the type of surgery and the maximum urine flow rate, the mean urine flow rate, duration of reaching the maximum speed, urination amount, urination duration, postopera-

tive urine flow rates, bladder capacity according to age, and residual urine (one-way ANOVA test,  $\chi^2$ -test).

## Discussion

Meatal stenosis is the main cause of urethral stricture in patients with hypospadias. This is a preoperative problem as well as a common and major postoperative complication. Uroflowmetry is preferred in the evaluation of the new urethra after surgery as it is useful in the diagnosis of symptomatic and asymptomatic urethral stenosis.

Of the 47 cases in our study, 80.85% were distal and 19.15% were proximal-type hypospadias, and the classification of the hypospadias according to the localization of the urethral meatus was consistent with the literature.

The incidence of complication after hypospadias surgery has been reported in many studies and has a wide range. The complication rate was reported to be 9% in the study of Akbıyık *et al.* [12] carried out on 496 cases where TIPU was performed in our clinic.

Our complication rate was 19.1%. We most commonly encountered the urethrocutaneous fistula and meatal

stenosis complications. Although the urethrocutaneous fistula rate was found to be 3–14% in many articles [13,14], it was 12.7% in our study.

Greenfield and colleagues observed a 2% diverticulum rate after repairs with preputium [15]. A diverticulum was observed in a penoscrotal hypospadias case repaired with the TIPU technique in our study (2.1%).

A stricture is a rare complication. The rate of this complication in the literature is quite low at 1% [16]. It was not encountered in any of the cases in our study.

Although a plateau-type curve is more common in studies reporting uroflowmetry results after hypospadias surgery [17,18], the bell-type flow was more common in our study.

Bell-type flow was the most common uroflow curve after surgery, but there was a significant decrease in plateau-type flow. This indicates that hypospadias surgery shortens the urine flow duration and increases urine flow.

There are many previous uroflowmetry studies on hypospadias patients. The mean flow rate was found to be low, with rates of 5–52% in postoperative uroflow investigations in these studies [19–24].

Comparison of the uroflowmetry results of the hypospadias cases with the control group showed lower flow rates with residual urine in the bladder before the surgery. When they were compared again postoperatively, there was a significant difference in the flow rate and residual urine amount between the postoperative hypospadias and control groups, but no such difference between the postoperative and preoperative evaluation results. These results indicate that the urination dynamic of the patients with hypospadias and partial obstruction in the urethra was present at the beginning and does not improve with surgery.

No significant relationship was found between the type of surgery used and uroflowmetry results in our study. The fact that partial obstruction is present from the start suggests that it is related to the pathology in hypospadias and independent of the surgery and that the possible spongy tissue defect cannot provide to the urethra the elastic support necessary for urination.

Preoperative and postoperative urethral urine flow and pressure studies are required to evaluate the urination dynamics of urethra in hypospadias cases.

## Conflicts of interest

There are no conflicts of interest.

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