Primary and Reoperative Hypospadias Repair in Adults—Are Results Different than in Children?

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**Purpose:** There is widespread belief that hypospadias surgery in adults has a greater urethroplasty complication rate than similar repair in children. We compared outcomes of primary and reoperative hypospadias repair in adults vs children.

**Materials and Methods:** We evaluated prospectively maintained databases of consecutive boys and adults, defined as Tanner 4 or greater, treated with primary or reoperative hypospadias repair from 2000 to 2013. We searched for urethroplasty complications, including fistula, glans dehiscence, stricture/stenosis and diverticulum. All operations were done with the goal of creating a neomeatus at the normal location at the tip of the glans. Univariate and multivariate analyses were done to determine whether pubertal status impacted urethroplasty complications.

**Results:** A total of 1,140 patients were operated on by a single surgeon, including 69 adults with a mean age of 23 years. Complications developed in 209 cases (18%), including 124 of 883 primary repairs (14%) and 85 of 257 reoperations (33%). There was no difference in outcomes between adults and children. Complications were noted in 1 of 8 men (12.5%) vs 123 of 871 children (14%) with primary repair (p = 0.9) and in 16 of 61 (26%) vs 69 of 196 (35%) with reoperation (p = 0.2). Multivariate analysis showed that a proximal meatus and reoperation were risk factors for complications but not pubertal status.

**Conclusions:** In contrast to popular belief, our data do not indicate a greater risk for urethroplasty complications after hypospadias surgery performed in adulthood. Repair in adults can be done using the same techniques as in children with the same goal of a neomeatus at the tip of the glans.

**Key Words:** penis, urethra, hypospadias, adult, reconstructive surgical procedures

Primary and reoperative hypospadias repairs in adults done using the same techniques as in children are reported to have a higher complication rate attributable to relatively decreased wound healing. Consequently some men may be recommended for subglanular repair, especially to avoid staged procedures.

Our surgical algorithm for hypospadias surgery is the same in prepubertal and postpubertal cases, including TIP, a 1-stage inlay graft or 2-stage graft repair. We previously analyzed results in consecutive prepubertal patients treated with primary or reoperative TIP and reported that urethroplasty complications were increased by a proximal meatal location and reoperation but not by increasing patient age. We now present our series of postpubertal...
hypospadias operations and reoperations to determine whether pubertal status is an independent factor predicting urethroplasty outcomes.

MATERIALS
After obtaining internal review board approval we reviewed the records of consecutive patients who underwent primary or reoperative hypospadias repair as performed by one of us (WTS). At the time of treatment predetermined factors were prospectively entered into databases, including patient age, pubertal stage, meatal location, primary or reoperative hypospadias, surgical repair type (TIP, inlay graft or 2-stage graft), glansplasty suture (chromic vs polyglactin) and urethroplasty complications (fistula, meatal stenosis, neourethral stricture, glans dehiscence or diverticulum). Only patients with less than 1 month of followup were excluded from analysis. Adults were defined as Tanner 4 or 5.

In all operations the neourethra was carried to the tip of the glans with the intent to create an orthotopic neomeatus. TIP was performed in all primary cases unless ventral curvature greater than 30 degrees persisted after the penis was degloved and a ventral dartos flap was excised. In those circumstances a 2-stage procedure was done using prepuce or lower lip as the graft source depending on a preference for circumcision or preputioplasty, respectively.

Our method of decision making for reoperation was previously described.4 Briefly, TIP was done when the urethral plate remained intact without gross scarring, and inlay grafting was performed when a skin neourethra was available without gross scarring. Two-stage oral mucosa grafting was done in patients with persistent ventral curvature greater than 30 degrees, gross scarring of the urethral plate, obliterator strictures or meatal stenosis that precluded inlay grafting, hair in the neourethra or BXO. Fistula closure without reoperative urethroplasty/glansplasty was not included in study.

The primary outcome variable was any urethroplasty complication, such as fistula, glans dehiscence, stricture, meatal stenosis, diverticulum and/or recurrent curvature greater than 30 degrees. Potential risk factors included age, pubertal status (less than Tanner 4 vs 4 or greater), meatal location, repair type, glans suture type and reoperation, which were analyzed by simple and multiple logistic regression analyses. Meatal stenosis was defined as calibration less than 8Fr in symptomatic boys and less than 12Fr in symptomatic men with stranguria, prolonged voiding and/or urinary retention. Glans dehiscence in all patients was defined as complete separation of the glans wings with or without a band of intervening skin that resulted in a coronal or more proximal meatus. Diverticulum was defined as visible sacculations of the urethra during voiding and/or urethrogram. All data were analyzed using SAS® 9.2 with p < 0.05 considered significant.

RESULTS
From 2000 to 2013 hypospadias repair was performed in 1,140 consecutive patients 3 months to 62 years old, including 883 (77%) primary operations and 257 reoperations (23%). Mean followup was 15 months (95% CI 13–16). Urethroplasty complications developed in 209 patients (18%), including 124 of 883 (14%) treated with primary repair and 85 of 257 (33%) treated with reoperation (p < 0.001). Of the patients 69 with a mean age of 23 years (range 13 to 62) were Tanner 4 or greater. Primary repair was performed in 8 patients, including proximal staged repair in 2 and distal TIP in 6 (fig. 1). There was a urethroplasty complication in 1 man (12.5%), that is a fistula after 2-stage repair. The urethral complication rate was similar in children who underwent primary repair (123 of 871 or 14%, p = 0.90).

The other 61 adults were treated with reoperations after up to 20 prior operations, including 19 TIPs, 14 inlay grafts and 28 staged oral grafts (fig. 2). There were 16 (26%) complications, including 8 fistulas, 5 glans dehiscences and 3 meatal stenoses, of which 1 was due to subsequent BXO. These complications in adults with reoperation were similar to those in prepubertal patients. Complications developed in 69 of 196 prepubertal patients (35%) (p = 0.21).

Multiple logistic regression revealed no increased risk of urethroplasty complications based on age or pubertal status (see table). Reoperation, a mid shaft meatus and a proximal meatus increased the risk of complications but suture type (chromic vs polyglactin) and surgery type (inlay or 2-stage graft vs TIP) did not.

DISCUSSION
We report a large series of men treated with hypospadias surgery. To our knowledge this is the only study comparing results in such men to those in prepubertal boys undergoing similar repair. Our analysis does not show that adults, defined as Tanner stage 4 or greater, were at increased risk.
for urethroplasty complications after hypospadias surgery based on age or pubertal status. This observation applies to those treated with primary or reoperative repair. Consequently these data suggest that there is no need to alter the general surgical approach to hypospadias surgery in adults vs children and no basis to recommend repair that leaves a subcoronal meatus in adults.

There are a few other reports specifically of the surgical outcomes of adult hypospadias. Hensle reported a series similar to ours of adults treated with primary or reoperative hypospadias repair. The 42 patients had a mean age of 22 years. There were 8 primary repairs and the remainder were reoperations. Surgical techniques in that study differed from ours since various flaps or 1-stage tubed grafts were used. Complications developed in 3 of 8 primary repairs (37%) and 19 of 32 reoperations (59%). While Hensle stated that these results clearly differed from those achieved by childhood repair, he reported no comparison group to demonstrate a significant difference.

We found 3 reviews of primary TIP in adults. Sharma reported on 13 men 18 to 26 years old who underwent distal (5) or mid shaft repair. During a mean followup of 6 months 1 patient had a fistula that closed spontaneously. There were no other urethroplasty complications. Adayener and Akyol described 12 men who underwent TIP in a cohort of 80 with a mean age of 22 years with distal hypospadias. The other patients were repaired by meatal advancement and glanuloplasty or the Mathieu technique. In 1 of the 12 men (8%) a fistula developed during followup at a mean of 19 months for a complication rate that was the same as the overall complication rate of 9%. A study by Hati-poglu et al included 27 men with a mean age of 22 years treated with primary distal (19) or mid shaft TIP. During a mean followup of 13 months urethroplasty complications developed in 5 men (19%), comprising 2 fistulas and 3 meatal stenoses. There was no comparison group of prepubertal boys treated with similar repair in any of these studies.

All other published series describe adults operated on for complications after hypospadias surgery in childhood. The largest study was the retrospective review of 60 men with a mean age of 32 years reported by Barbagli et al. Various repairs were done, including meatotomy, fistula closure, flaps, inlay or ventral onlay grafts and 2-stage grafts. During the mean 34-month followup the overall urethroplasty complication rate was 25%, ranging from 13% after fistula closure or meatotomy to 20% after 1-stage grafts and flaps, and 32% after staged grafts.

Myers et al reviewed prospectively collected data on reoperations performed by a single surgeon in 50 men with a mean age of 38 years. Indications were urethral stricture in 72% of cases, including some in the bulb proximal to the site of prior hypospadias surgery, fistula in 24% and persistent hypospadias in 14%. These conditions were corrected by various 1 and 2-stage techniques, including grafts and flaps. Subsequently urethroplasty complications developed in 50% of patients, mostly

<table>
<thead>
<tr>
<th>Multiple logistic regression based on age as continuous variable and pubertal status in 1,140 patients</th>
<th>OR (95% CI)</th>
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<tbody>
<tr>
<td>Age *</td>
<td>0.97 (0.94–1.00)</td>
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<tr>
<td>Reoperation</td>
<td>2.22 (1.85–2.66)</td>
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<tr>
<td>Mid shaft meatus</td>
<td>2.44 (1.42–4.18)</td>
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<tr>
<td>Proximal meatus</td>
<td>4.92 (3.41–7.09)</td>
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<tr>
<td>Tanner 4–5:†</td>
<td>0.56 (0.30–1.04)</td>
</tr>
<tr>
<td>Reoperation</td>
<td>2.34 (1.55–3.44)</td>
</tr>
<tr>
<td>Mid shaft meatus</td>
<td>2.34 (1.36–4.03)</td>
</tr>
<tr>
<td>Proximal meatus</td>
<td>4.20 (2.84–6.22)</td>
</tr>
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* AUC = 0.710.
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Figure 2. Two-stage oral graft reoperation. A, persistent hypospadias with flat-appearing ventral glans. B, contracted neourethra constructed with hair-bearing skin flap, which was excised and replaced with lower lip oral graft. C, healed graft 6 months later. D, final appearance.
recurrent strictures or fistulas. Myers et al concluded that many techniques were needed to correct the heterogenous problems in these men. They also stated that outcomes were worse than in other men treated with urethroplasty for non-hypospadias related conditions but they did not report these results using their database.

Finally, Armenakas et al studied adults with fossa navicularis strictures, which resulted from prior hypospadias repair in only 5 of 40 (12.5%). Of these cases 16 were considered most challenging with complex strictures related to prior hypospadias or another urethroplasty and/or BXO. These men were treated with extended meatomomy by cutting the urethra open until a 24Fr lumen was achieved. The neomeatus was on the distal shaft to the subcoronal region. Stenosis recurred in 2 cases (12%). Extended meatomomy was proposed as an alternative to the staged reconstruction elected by these patients.

We used only 3 repair techniques in our large population of pediatric and adult patients representing the complete spectrum of primary and reoperative hypospadias. Our data emphasize the need to achieve success with initial repair because multiple logistic regression showed that reoperation carries more than twofold odds of subsequent urethroplasty complications. As expected, mid shaft and proximal meatal locations were also risk factors for complications. Given the relative scarcity of patients with mid shaft and more proximal hypospadias, we recommended that they be referred to a single surgeon in a large group to focus experience. However, we did not find that age, or pubertal status Tanner 4 or greater impacted outcomes after primary or reoperative repairs, which were performed as in children by creating a neomeatus at the glans tip.

There likely are adults with long-standing symptoms from failed hypospadias surgeries, or other mitigating health or social reasons who elect a proximal meatus rather than staged repair. However, our data indicate that reconstructive surgeons need not encourage a patient to accept a subcoronal meatus by raising concern for increased complications specifically due to age.

Our study has potential limitations. Our adult patients were relatively young and, therefore, not likely to have vascular disease that would impact wound healing, which might be more prevalent in an older cohort. We report outcomes in consecutive patients and so adults who seek hypospadias surgery may tend to be young. However, our statement that the overall health of the patient should be considered in surgical decision making applies to adult and pediatric patients. Mean followup was 15 months and it is possible that additional complications will be diagnosed at longer followup, but there is no reason to suspect that late complications would differ in the 2 cohorts. Other reconstructive surgeons may follow different decision making algorithms than we report but our data using these 3 surgical techniques suggest that outcomes should be similar in adults and children.

CONCLUSIONS

To our knowledge we report the only comparison of hypospadias surgery in adults and children. We found similar urethroplasty complication rates. Our data do not support the conclusion that adults are at greater risk for complications after hypospadias repair. Rather, our findings indicate that adults can undergo repair using techniques similar to those in children and with the same goal of creating a neomeatus in the correct glanular position.

REFERENCES