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Adolescent and Young Adult Urogenital Outcome following Childhood Hypospadias Repair: Perfection Revisited

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Full-length article available at www.auajournals.org/doi/10.1097/JU.0000000000001869.

Study Need and Importance: Recent data suggest that the incidence of hypospadias is steadily increasing, affecting up to 1/200 newborn males. Numerous surgical techniques have been developed to achieve a cosmetically appealing and fully functional penis, numerous surgical techniques have been developed. However, the multitude of techniques with overall high complication rates and scarce long-term data regarding functional outcomes and optimal timing of hypospadias repair, render counseling of parents and patients difficult. Therefore, we conducted a cross-sectional study exploring the surgical, voiding and sexual outcome of men born with various, non-syndromic forms of hypospadias (193) compared to healthy male peers (50) in 2 European reference centers, reflecting 16.4 [8.2–21.2] years of followup after primary hypospadias repair.

What We Found: One or more re-interventions were performed in 39.2%, sometimes over a decade after initial repair. The highest need for re-interventions was observed in those younger than 12 months at initial repair, even when excluding proximal hypospadias cases. A disturbed urinary and/or suboptimal sexual functional outcome was seen in 52.9% of cases. More re-interventions and proximal hypospadias were associated with suboptimal urinary outcome and the latter also with impaired sexual function (see figure). Poor inter-observer agreements were found between physician's and patient's genital appraisal, with in general higher scores given by patients.

Limitations: Retrospective collection of surgical data and small subgroups made comparison of specific surgical techniques impossible. Measurements of stretched penile length at primary repair and details regarding chordee correction were missing.

Interpretation for Patient Care: Primary hypospadias repair can best be deferred until over 12 months of age. Postsurgical complications are frequent and can occur late; therefore, followup well into adulthood is mandatory. Given that genital appraisal is subjective, physicians should focus on functional outcomes; aesthetic refinement is recommended only upon patient request.

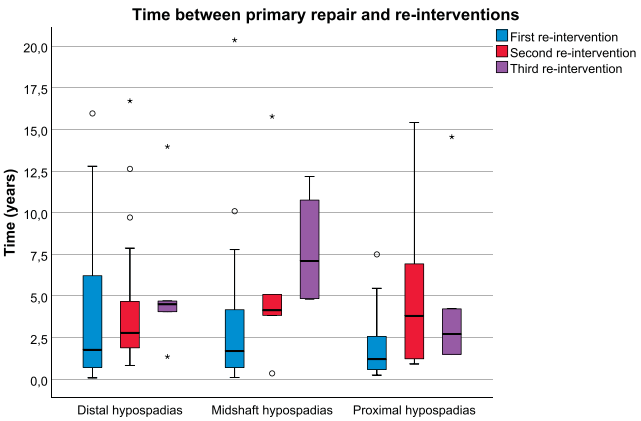

Figure. Time between first hypospadias repair and first, second and third reintervention.

0022-5347/21/2063-0734/0
THE JOURNAL OF UROLOGY®

https://doi.org/10.1097/JU.0000000000001869
Vol. 206, 734-744, September 2021
Printed in U.S.A.

THE JOURNAL of UROLOGY®
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Adolescent and Young Adult Urogenital Outcome following Childhood Hypospadias Repair: Perfection Revisited

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Purpose: We assessed the long-term surgical, functional urinary and sexual outcomes of adolescent and young adult men who underwent childhood hypospadias repair.

Materials and Methods: Men born with nonsyndromic hypospadias and healthy male controls aged 16–21 years old were recruited, and their surgical, urinary, sexual functional and aesthetic outcomes assessed. Good outcome was defined as a patent and orthotopic meatus without fistulas, and straight erections (<30 degree curvature) without erectile or ejaculatory problems. Statistics included regression analyses, chi-square/Fisher exact tests and Student's t/Mann-Whitney U and Kruskal-Wallis tests.

Results: A total of 193 patients and 50 controls participated 16.4 years (range 8.2–21.2) after initial repair. At least 1 reintervention was performed in 39.2%. The highest reintervention rate was found in those younger than 12 months at initial repair, even when excluding proximal hypospadias cases. A disturbed urinary and/or suboptimal sexual functional outcome was seen in 52.9% of cases. Suboptimal voiding was found in 22.1%, although few had relevant residual urine. More reinterventions and proximal hypospadias cases were associated with suboptimal urinary outcome, and the latter also with impaired sexual function. Poor inter-observer agreements were found between physician and patient genital appraisal.

Conclusions: In 52.9% of cases, at least 1 concern was identified that required long-term followup. Hypospadias repair below 12 months was associated with more reinterventions. Adopting a restrictive attitude toward aesthetic refinement, unless on the patient's own request, could improve urinary outcomes.

Key Words: hypospadias; treatment outcome; urologic surgical procedures, male

Abbreviations and Acronyms

FI = flow index
GUH = Ghent University Hospital
HOPE = Hypospadias Objective Penile Evaluation
IIEF-5 = International Index of Erectile Function
MUV = Medical University of Vienna
PPPS = Pediatric Penile Perception Score
SPL = stretched penile length

HYPOSPADIAS affects approximately 2 out of 1,000 newborn males, with great differences between populations.[1] The severity ranges from glandular to perineal hypospadias and can be isolated or coincide with other genital findings (ie cryptorchidism, micropenis or bifid scrotum), then referred to as complex hypospadias.[2] Although the cause of the urethral defect is idiopathic in the majority of patients, some genetic causes and associations with prenatal conditions have been identified.[3,4]

Numerous hypospadias repair techniques have been developed, as

Accepted for publication April 19, 2021.

Authors' roles: LJWT and MC: funding acquisition; LJWT, MC, AS, AFS, AM and PH: conceptualization and methodology. LJWT, AS, SR, UT, JW and MH: resources; LJWT, AS, JW, MH, AFS, EVL, AM and PH: investigation; LJWT, MC, AFS: formal analysis and data curation; all authors: writing (original draft and review/editing).

Supported by grants from the European Society of Paediatric Endocrinology (LJWT), Belgian Society of Pediatrics (LJWT), Belgian Society of Pediatric Endocrinology and Diabetology (LJWT), and the Flanders Research Foundation (LJWT, MC).

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See Editorial on page 505.

0022-5347/21/2063-0735/0
THE JOURNAL OF UROLOGY®

https://doi.org/10.1097/JU.0000000000001869
Vol. 206, 734-744, September 2021
Printed in U.S.A.

standardization is currently lacking.[5] High complication rates have been reported following hypospadias repair, which can present shortly after the initial surgery but also decades later, making comparison of outcomes and surgical techniques particularly difficult.[5–7] Moreover, factors associated with suboptimal surgical and functional urinary and sexual outcomes are under studied and inconsistently reported.[8]

A cross-sectional case-control study was performed at Ghent University Hospital (GUH) and Medical University of Vienna (MUV) aimed at exploring the long-term psychosexual, urological, surgical, endocrine and reproductive outcomes in a large cohort of adolescent and young adult men born with all forms of nonsyndromic hypospadias. This manuscript focuses on the surgical and urological outcomes compared to healthy male peers. Psychosexual outcomes have been reported elsewhere.[9] We hypothesized that the urological outcome following hypospadias repair is often functionally suboptimal and is associated with the severity of the hypospadias, age at first surgery, reinterventions and adult penile size.

MATERIALS AND METHODS

Participants

Men aged 16 to 21 years treated for nonsyndromic hypospadias at GUH or MUV were sent an invitation letter (October 2017–September 2019). Two weeks later, all were contacted by phone to explain the aim and modalities of the study. Healthy age-matched controls were recruited through social media, flyers and posters in schools and universities. Exclusion criteria for controls were genital anomalies or surgeries, except circumcision.

Ethical Approval

Approval was obtained from both local ethics boards (GUH IRB No. B670201835984, MUV IRB No. 1547/2018). Written consent was obtained from all participants prior to participation, including written consent of parents if the participant was younger than 18 years. The principles of the Helsinki declaration were respected at all times.

Uroflowmetry

Uroflowmetry was followed—within 5 minutes—by ultrasound of the bladder to screen for residual urine. In case the voided volumes were not between 100 and 500 ml, the uroflowmetry was repeated if the participant was willing. Residual volumes >50 ml were considered clinically relevant. A flow index (FI) was calculated according to the formula reported by Franco et al (supplementary material and supplementary fig. 1, https://www.jurology.com).[10]

Questionnaires and Genital Examination

Three questionnaires were used: the Pediatric Penile Perception Score (PPPS), complemented by rates for appearance of the scrotum and overall genital appearance; the International Index of Erectile Function (IIEF-5) and a custom questionnaire assessing ejaculatory problems.[9,11–13] Ejaculatory problems were defined as premature, late or anejaculation, sensory problems (including pain) and post-orgasmic milking of the urethra. The latter was rarely reported spontaneously, and therefore this question was added after the start of the study (last 81 consecutive cases).[9]

A genital examination was performed by the same pediatrician (LJWT) trained in assessing the urethral meatus location and screening for fistulas, hypertrophic scars and other findings. Stretched penile length (SPL) was measured.[14] The Hypospadias Objective Penile Evaluation (HOPE) score was obtained,[15] and overall appearance of the penis and scrotum was scored using the same scale. In case of abnormalities, reassessment was performed by a senior urologist (AFS, AS, EVL, PH). All participants were asked to bring 2 pictures of their penis in erection (top and side views) to detect curvatures. In the event participants reported not to have any relevant curvature in erection and did not provide pictures, they were input as normal.

Defining Suboptimal Outcome

This study focused on surgical and urological outcomes as perceived by urologists. Therefore an evidence-based consensus defining suboptimal outcome after hypospadias repair was sought among all involved urologists after review of the relevant literature. It was agreed that outcome measures should reflect urinary and sexual function, which represent the 2 essential penile functions. Good urinary outcome was defined as having a patent, orthotopic meatus without fistulas (ie combined urinary outcome). A good sexual outcome was defined as having a straight erection (<30 degree curvature) and no erectile or ejaculatory problems (ie combined sexual functional outcome).

Statistical Analysis

Statistical analysis was performed using SPSS® 27.0. Guidance in the choice and interpretation of statistical tests was provided by the statistics department of Ghent University. Linear regression or (multinomial) logistic regression was used as appropriate. Severity of hypospadias, SPL and age at first hypospadias surgery were chosen as covariates to assess surgical outcome. Cases that were referred to GUH or MUV after failed first surgery were excluded from the regression analyses regarding the surgical outcome (17 patients). For urinary, sexual and aesthetic outcomes, the severity of hypospadias and number of reinterventions (none/1/multiple) were used as covariates. All regression analyses were performed twice: separate analysis of the covariates and once combined (supplementary material, https://www.jurology.com). Other analyses included a chi-square or Fisher exact test for categorical variables and a Mann-Whitney U test or unpaired Student's t-test for continuous variables, as appropriate. A Cohen's kappa was used to calculate the inter-observer agreement of the FI and visual interpretation of the voiding curve, and the patient (PPPS) and physician (HOPE) genital appraisal. A Kruskal-Wallis test was used to compare the age at initial surgery of distal, mid shaft and proximal hypospadias.

Table 1. *Characteristics of study group*

	No. (%)
Location of urethral meatus at birth—invited men:	
Distal*	407 (75.8)
Mid shaft†	69 (12.8)
Proximal‡	61 (11.4)
Undocumented§	19 (3.4)
Total	556
Location of urethral meatus at birth—participants:	
"Hypospadias sine hypospadias"‖	2 (1.0)
Glandular	24 (12.4)
Coronal	106 (54.9)
Mid shaft	38 (19.7)
Penoscrotal	20 (10.4)
Scrotal	3 (1.6)
Total	193
Associated genital anomalies:	
Cryptorchidism¶	15 (7.8)
Micropenis	3 (1.6)
Bifid scrotum/penoscrotal transposition	7 (3.6)
Total complex hypospadias**	23 (11.9)

Meatal locations were determined by treating physician on first presentation in urology department. Surgeries in invited men and participants were performed by same surgeons, using same techniques for similar clinical presentations during same time periods.
* Orthotopic to subcoronal urethral meatus.
† Urethral meatus along penile shaft.
‡ Penoscrotal to perineal urethral meatus.
§ Location of urethral meatus was undocumented in patient files.
‖ Orthotopic urethral meatus with unfused foreskin and/or chordee.
¶ Congenital and acquired cryptorchidism.
** Total number of cases with 1 or multiple other associated genital anomalies.

RESULTS

Participants

Participation rate of cases was 48.5% (supplementary fig. 2, https://www.jurology.com). Reasons not to participate were lack of interest, not wanting to undergo certain tests (eg endocrine and reproductive assessment) and difficulties reaching the hospital. Participants included 193 patients and 50 controls who had median ages of 18.1 years (IQR: 2.35) and 19.6 years (IQR: 1.79), respectively. Table 1 summarizes the urethral meatus location at birth and associated genital anomalies.

Surgeries

Included cases (176) had primary hypospadias repair at GUH or MUV between September 1997 and February 2010. Performed surgeries are summarized in supplementary table 1 (https://www.jurology.com).

No patient was treated with testosterone prior to surgery. Median age at first hypospadias repair was 1.5 years (IQR: 1.58), with different age distributions in distal, mid shaft and proximal hypospadias ($p=0.004$). No repairs were performed before the age of 6 months. Age at first repair and time until first reintervention were similar at GUH and MUV ($p=0.267$ and 0.256, respectively). One or multiple reinterventions were performed in 39.2% of cases. More reinterventions were performed at MUV ($p=0.044$). Times between the initial procedure and first reintervention were similar according to hypospadias severity and sometimes exceeded a decade, especially in distal hypospadias ($p=0.857$; fig. 1).

Smaller adult SPL, surgery before 1 year of age and proximal hypospadias were associated with more reinterventions. The latter was not significant in the combined model. These associations were not found for those who only had one reintervention. More distal and mid shaft cases had at least 1 reintervention if the primary repair was performed before the age of 1 year vs after 1 year (61.8% vs 36.8%, $p=0.009$; table 2). Proximal hypospadias cases had

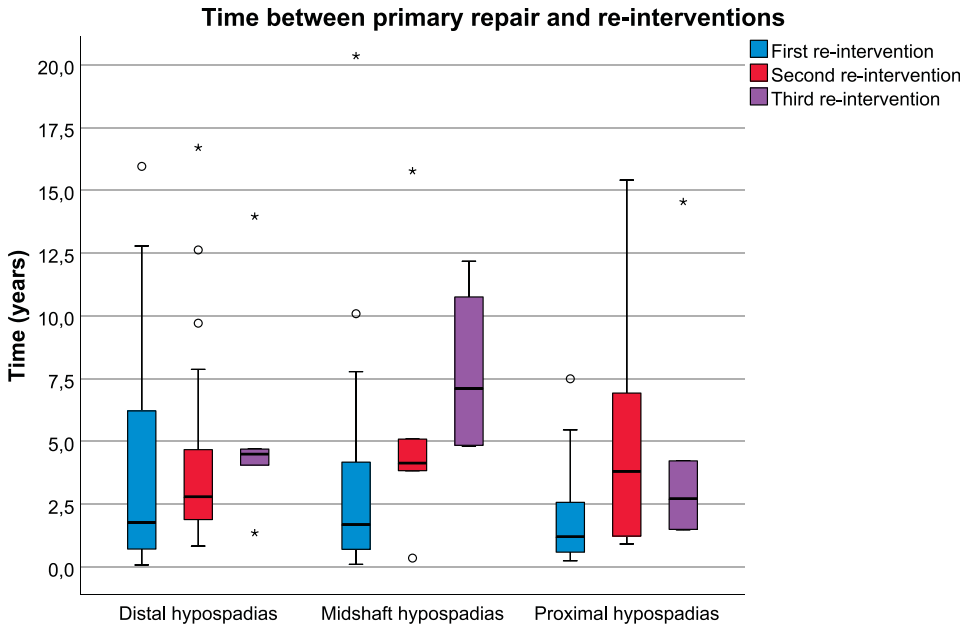

Figure 1. Time between first hypospadias repair and first, second and third reintervention.

Table 2. *Reinterventions per age group in hypospadias patients with first surgery at GUH/Vienna Medical University*

Age (yrs)	No. No Reintervention (%)	No. 1 Reintervention (%)	No. Multiple Reinterventions (%)	No./Total Pts (%)
Hypospadias cases:	107 (60.8)	42 (23.9)	27 (15.3)	
0–1	20 (45.5)	12 (27.3)	12 (27.3)	44/176 (25.0)
1–2	49 (61.3)	19 (23.8)	12 (15.0)	80/176 (45.5)
>2	38 (73.1)	11 (21.2)	3 (5.8)	52/176 (29.5)
Distal:	70 (56.9)	38 (30.9)	15 (12.2)	
0–1	11 (40.7)	10 (37.0)	6 (22.2)	27/123 (22.0)
1–2	30 (56.6)	16 (30.2)	7 (13.2)	53/123 (43.1)
>2	29 (67.4)	12 (27.9)	2 (4.7)	43/123 (35.0)
Mid shaft:	22 (61.1)	8 (22.2)	6 (16.7)	
0–1	2 (28.6)	3 (42.9)	2 (28.6)	7/36 (19.4)
1–2	13 (61.9)	4 (19.0)	4 (19.0)	21/36 (58.3)
>2	7 (87.5)	1 (12.5)	0 (0.0)	8/36 (22.2)
Proximal:	9 (52.9)	2 (11.8)	6 (35.3)	
0–1	5 (50.0)	1 (10.0)	4 (40.0)	10/17 (58.8)
1–2	4 (66.7)	1 (16.7)	1 (16.7)	6/17 (35.3)
>2	0 (0.0)	0 (0.0)	1 (100.0)	1/17 (5.9)

more reinterventions for fistulas and residual hypospadias and less for aesthetic reasons. Reinterventions for stenosis were linked to smaller adult SPL. Larger adult SPL and surgery after 2 years were associated with a longer interval between primary surgery and first reintervention (fig. 2, *A* and supplementary table 2, https://www.jurology.com).

Urinary Outcome

Uroflow results are summarized in table 3. Combining the calculated thresholds of the maximum and mean FI and visual interpretation of the voiding curve revealed suboptimal voiding in 22.1% of hypospadias cases, with a moderate level of agreement between visual interpretation of the voiding curve and use of the FI (table 4 and fig. 3). Fistulas and residual hypospadias were seen in 5.7% and 24.9% of cases, respectively. Five of 191 hypospadias cases (2.6%) and 1 of 50 controls (2.0%) had residual urine.

The combined (voiding, meatal position and presence of fistulas) urinary outcome was more likely to be suboptimal in proximal hypospadias and multiple reinterventions ($p=0.040$ and 0.001, respectively; fig. 2, *B*). Similar trends were seen for suboptimal voiding, fistula and residual hypospadias separately, only reaching significance in the latter (supplementary table 3, https://www.jurology.com).

Sexual Outcome

Overall, sexual function problems were reported in 20.3% of cases vs 6.0% of controls. In total, 157 patients (81.3%) provided a picture of their penis in erection, including all those who reported to have a curvature in erection. Limited data were available regarding initial chordee correction. In most cases where the surgery was documented, careful degloving with chordee resection had been performed. Ventral lengthening was not reported and only few cases had dorsal plication (data not shown). A curvature of the penis of more than 30 degrees was rare in distal hypospadias compared to mid shaft and proximal hypospadias ($p=0.038$ and 0.003, respectively; table 5 and supplementary table 4, https://www.jurology.com). Ten cases (11.2%) had (mild) erectile dysfunction (IIEF-5 <22), and 23 (12.0%) had ejaculatory problems. No associations were found with the severity of hypospadias and reinterventions (supplementary table 4, https://www.jurology.com). A suboptimal combined (>30 degree curvature, erectile or ejaculatory problems) sexual functional outcome was more common in proximal vs distal hypospadias (39.1% compared to 16.8%, $p=0.037$; fig. 2, *B*). In total, 99 of 187 cases (52.9%) had a suboptimal combined urinary and/or sexual functional outcome, opposed to 10 of 49 controls (20.4%).

Aesthetic Outcome and Genital Examination

Overall, poor inter-observer agreements were seen between the patient (PPS) and physician (HOPE) genital appraisal (table 6 and supplementary table 5, https://www.jurology.com). The physician rated proportionally more aspects as abnormal, except for penile size and axis in erection. The highest agreement was found regarding the axis of the penis in erection, whereas the lowest was seen in overall genital appearance. Patient genital appraisal was lower in proximal hypospadias ($p<0.001$), but was not associated with reinterventions in the combined analysis (supplementary table 6, https://www.jurology.com). Physician genital appraisal was lower in proximal hypospadias and with 1 and multiple reinterventions ($p<0.001$, 0.008 and <0.001, respectively; fig. 2, *B*).

DISCUSSION

We previously reported the psychosexual outcome and patient and parental satisfaction in adolescents and young adults who had childhood hypospadias repair.[9] This study focuses on surgical and

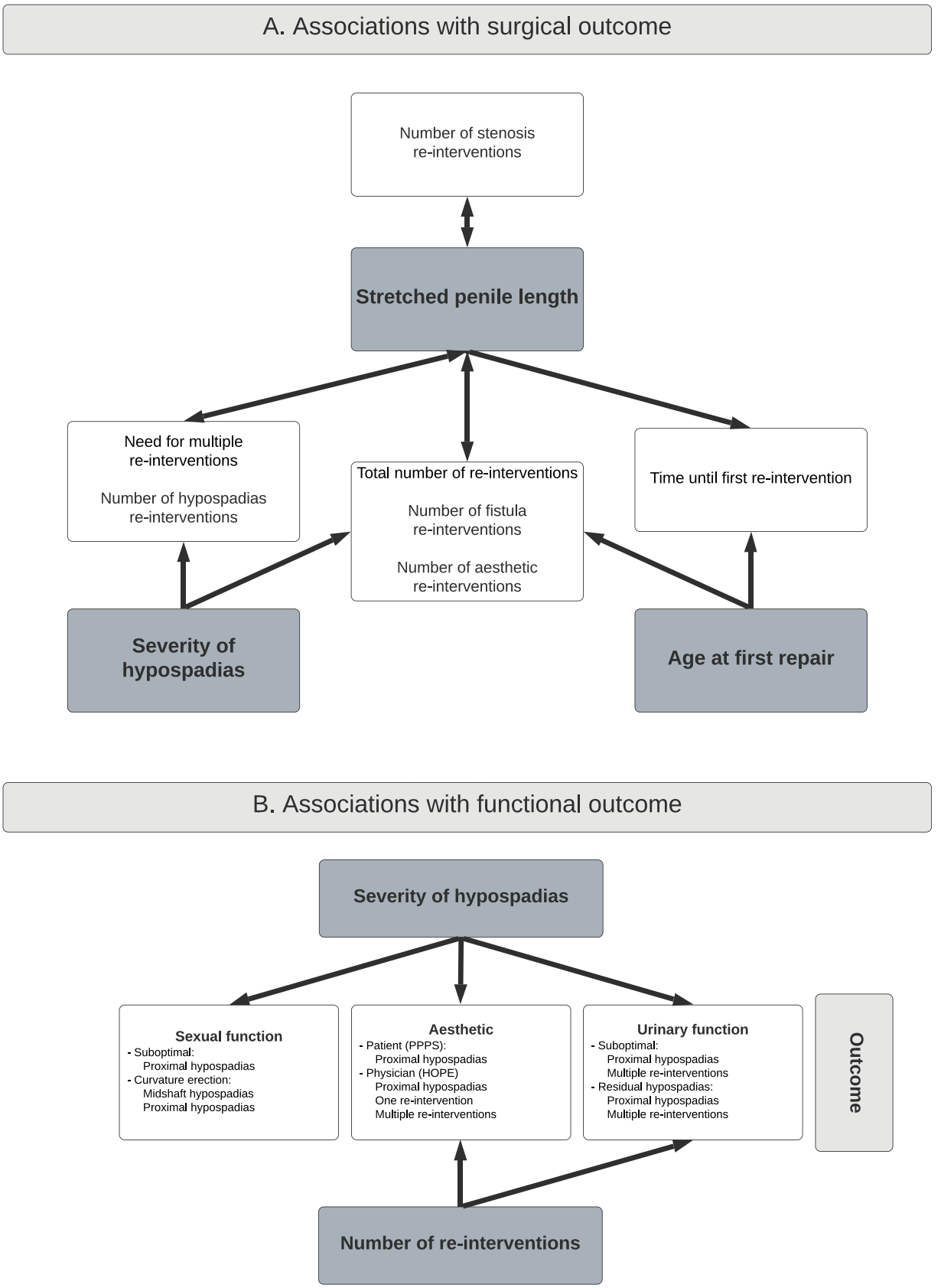

Figure 2. *A*, diagram of factors associated with surgical outcome. Double-headed arrows indicate potential bi-directional interaction. *B*, diagram of factors associated with functional outcomes.

Table 3. *Uroflow results—urinary outcome*

	Hypospadias	Distal	Mid shaft	Proximal	Controls
No. curve/total No. (%):*					
Bell	147/181 (81.2)	103/124 (83.1)	28/36 (77.8)	16/21 (76.2)	43/45 (95.6)
Plateau	32/181 (17.7)	19/124 (15.3)	8/36 (22.2)	5/21 (23.8)	0/50 (0.0)
Staccato	2/181 (1.1)	2/124 (1.6)	0/36 (0.0)	0/36 (0.0)	2/45 (4.4)
FI mean:					
Mean±SD	0.84±0.309	0.85±0.310	0.83±0.315	0.76±0.292	0.85±0.299
No. suboptimal/total No. (%)	35/179 (19.6)	22/122 (18.0)	8/36 (22.2)	5/21 (23.8)	7/43 (16.3)
FI max:					
Mean±SD	0.85±0.261	0.87±0.269	0.84±0.231	0.76±0.257	0.87±0.204
No. suboptimal/total No. (%)	46/179 (25.7)	28/122 (23.0)	9/36 (25.0)	9/21 (42.9)	8/43 (18.6)
No. FI total/total No. (%):†					
Normal	149/179 (83.2)	103/122 (84.4)	29/36 (80.6)	17/21 (81.0)	38/43 (88.4)
Suboptimal	30/179 (16.8)	19/122 (15.6)	7/36 (19.4)	4/21 (19.0)	5/43 (11.6)
No. combined/total No. (%):‡					
Normal	139/181 (76.8)	98/124 (79.0)	27/36 (75.0)	14/21 (66.7)	38/45 (84.4)
Suboptimal§	40/181 (22.1)	24/124 (19.4)	9/36 (25.0)	7/21 (33.3)	5/45 (11.1)
StaccatoII	2/181 (1.1)	2/124 (1.6)	0/36 (0.0)	0/21 (0.0)	2/45 (4.4)
No. fistula/total No. (%):	11/193 (5.7)	7/132 (5.3)	1/38 (2.6)	3/23 (13.0)	Not applicable
No. residual hypospadias/total No. (%)¶	48/193 (24.9)	25/132 (18.9)	12/38 (31.6)	12/23 (52.2)	Not applicable
No. combined/total No. (%):					
Good	107/181 (59.1)	81/124 (65.3)	19/36 (52.8)	7/21 (33.3)	38/45 (84.4)
Suboptimal	74/181 (40.9)	43/124 (34.7)	17/36 (47.2)	14/21 (67.7)	7/45 (15.6)

* Visual interpretation of voiding curve.
† Combining the flow index mean and max in which suboptimal is defined as both FI mean and max below the calculated threshold.
‡ Combining the FI total and visual interpretation.
§ Suboptimal based on visual interpretation or FI total as suboptimal.
II Based solely on visual interpretation.
¶ Meatal location which is not on the tip of the penis after hypospadias repair.

functional urinary and sexual outcomes as deemed relevant for urologists in the same cohort and aims to identify surgical factors associated with suboptimal outcomes.

In our cohort, 39.2% cases had at least 1 reintervention after hypospadias repair, sometimes performed 1–2 decades after initial surgery. Of note, 52.9% had a suboptimal urinary and/or sexual functional outcome compared to 20.4% of controls, further reflecting the precarious surgical outcome. This is in line with other studies, supporting the organization of urological followup through adolescence and adulthood.[5,6] Higher reintervention rates at MUV can be explained by the initial lack of a specialized team before 2012, emphasizing the need for centralization of hypospadias repair at reference centers, as recommended by current guidelines.[16]

There is general surgical agreement that hypospadias should be repaired early.[17] However, unconsented genital surgery is increasingly controversial, and some plea to defer hypospadias repair until the age of maturity.[18–20] We previously reported less patient satisfaction with increasing age at first hypospadias repair.[9] In this study, primary repair prior to 12 months of age was associated with more reinterventions, even when excluding proximal hypospadias. No further decrease of reinterventions was seen after 12 months. These findings could result from smaller penile sizes, as the penis grows significantly in the first year of life. Another factor could be the hypergonadotropic surge, which fades out during the first year of life. This is a testosterone high phase that can lead to worse wound healing.[21] Of note, all cases were prepubertal at the time of primary repair. The association between reintervention rates and age at first repair has been inconsistently reported and remains controversial.[22,23] However, pubertal and adult hypospadias repair is thought to be associated with inferior outcomes.[24,25] Therefore, childhood repair is warranted, but these data support deferral until at least 12 months of age, consistent with current guidelines.[16]

Although adult SPL was an important factor for surgical outcome, SPL at first surgery was unavailable, rendering comparison with adult SPL impossible. It is unclear if the association of adult SPL with reinterventions is caused by the higher surgical complexity of more severe hypospadias, smaller operative penile length or poor tissue quality associated with restricted penile development.[26] Furthermore, multiple penile surgeries could potentially impair penile growth and thus result in shorter adult SPL.

Table 4. *Interpretation of voiding curve vs calculated flow index*

	Degree of Agreement*	p Value†
FI max	0.643	<0.001
FI mean	0.578	<0.001
FI combined‡	0.649	<0.001

* Cohen's kappa comparing visual interpretation of voiding curve (bell or plateau curve) and flow index thresholds in hypospadias cases.
† All differences were statistically significant.
‡ Both FI mean and FI max are below threshold.

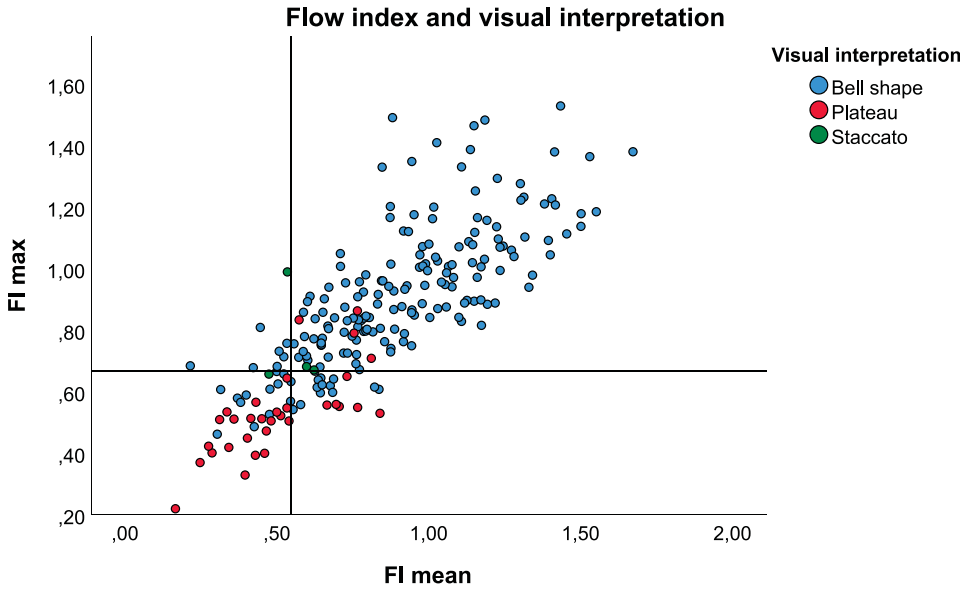

Figure 3. Scatterplot of maximum and mean flow index with stratification of visual interpretation of voiding curve.

Proximal hypospadias was associated with poor surgical outcomes in the separate regression analysis of surgical outcome, but not when controlling for SPL and age at first surgery in the model. This discrepancy can be due to a lower SPL and younger age at first surgery in proximal hypospadias cases. However, the study design cannot assess causality. Therefore, longitudinal studies are warranted to confirm and explain our findings.

Both a visual inspection of the voiding curve by an experienced pediatric urologist and the FI were used in this study, as we believe both methods are complementary.[10] The FI offers a quantitative approach and could help decision making and followup. In our cohort 22.1% of patients had a suboptimal flow and 2.6% had clinically relevant residual urine. In addition, 15.7% had undergone at least 1 reintervention for stenosis. The urinary outcome was more likely to be suboptimal in proximal hypospadias and with multiple reinterventions. Other studies of long-term followup and in adults have revealed a similar high prevalence of suboptimal voiding and related complications, underscoring the need for uroflowmetry during followup.[27–30]

A suboptimal sexual function was found in 20.4% of cases, which was not associated with reinterventions, as compared to 6.0% of controls. Similar to our previous findings, poor inter-observer agreements were seen regarding the aesthetic outcome between physician (HOPE) and patient (PPPS) genital appraisal. Several cases have hypertrophic scar tissue, fistulas, residual hypospadias, significant curvature in erection or other suboptimal aesthetic factors. Yet few were dissatisfied or perceived this as problematic, and none was actively seeking medical advice. Moreover, more reinterventions did not affect patient genital appraisal in the combined analysis. Based on these results and our previous findings of higher parental decisional regret and a negative influence of more reinterventions on patient psychosexual development, we advise to refrain from

Table 5. *Sexual outcome*

	No./Total No. (%)				
	Hypospadias	Distal	Mid shaft	Proximal	Controls
Curvature*	12/193 (6.2)	3/132 (2.3)	4/38 (10.5)	5/23 (21.7)	0/50 (0.0)
Sexually active	89/192 (46.4)	64/131 (48.9)	17/38 (44.7)	8/23 (34.8)	38/50 (76.0)
IIEF-5†	10/89 (11.2)	7/64 (10.9)	2/17 (11.8)	1/8 (12.5)	2/38 (5.3)
Ejaculation‡	23/192 (12.0)	16/131 (12.2)	3/38 (7.9)	4/23 (17.4)	2/50 (4.0)
Combined§	39/192 (20.3)	22/131 (16.8)	8/38 (21.1)	9/23 (39.1)	3/50 (6.0)

One patient refused to answer questions regarding his sexual functioning.
* Curvature in erection of >30 degrees.
† IIEF-5 score below 22 indicating erectile dysfunction (only when sexually active).
‡ Any reported problems regarding ejaculation.
§ Contains curvature in erection (>30 degrees), erectile dysfunction (only when sexually active) and/or problems with ejaculation.

Table 6. *Interobserver agreement of genital appraisal in hypospadias cases*

	Interobserver Agreement (κ)*	p Value
Urethral meatus position	0.279	<0.001†
Glans shape	0.171	0.010†
Penile skin shape	0.125	0.081
Erect penile axis	0.467	<0.001†
Penile length	0.150	0.004†
Scrotal appearance	0.147	0.035†
Genital appearance	0.020	0.743

* Cohen's kappa comparing related topics of PPPS (scored by patient) and HOPE (scored by physician).
† Difference was statistically significant.

surgical aesthetic refinement, unless on patient's active request.[9]

Strengths of this study are the large cohort of cases, participating more than a decade after initial repair and controls of 2 specialized pediatric urology departments, allowing state-of-the-art data collection. Weaknesses include the lack of SPL at first surgery and retrospective collection of surgical data.

CONCLUSIONS

A reintervention rate of 39.2% was seen following hypospadias repair, with late complications observed up to 2 decades after initial repair. The highest reintervention rates were found in primary hypospadias repair prior to 12 months of age. In 52.9% of patients, a suboptimal urinary and/or sexual functional outcome was found. Suboptimal urinary outcome was significantly associated with multiple reinterventions. Due to the lack of agreement on aesthetic outcome between patients and surgeons, we suggest delaying aesthetic refinement until a patient's active request and to focus more on functional outcome. Avoidance of surgery before the age of 1 year and the organization of urological standardized followup well into adulthood can be recommended.

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EDITORIAL COMMENTS

Correction of hypospadias remains a challenging endeavor with a myriad of different operative techniques to address a wide spectrum of severity. Successful repair must adequately address all associated abnormalities while minimizing complications. Work over the past decade has shown the complication rate, particularly in boys with proximal hypospadias, is significantly higher than initially thought. While half of postoperative complications are identified in the first year, longer followup universally yields higher complication rates, underscoring the importance of long-term urological care.[1]

In addition to complication rates and the urinary effects of hypospadias repair, long-term psychosocial and sexual outcomes have also come to the forefront. In the current manuscript, using uroflowmetry and various questionnaires, Tack et al add to their previous work in adolescents and young men following childhood hypospadias repair (reference 9 in article). Over half of all patients reported suboptimal urinary or sexual outcomes, compared to just over 20% of controls, and nearly 40% had at least 1 additional intervention. Importantly, reoperations were performed up to 2 decades after initial repair—again stressing the need for appropriate preoperative counseling and ongoing urological followup. This notable work adds to a growing body of literature that begs the question, "Are we as good at hypospadiology as we think?" Probably not.

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This large long-term case-control study compares 176 men with a history of hypospadias repair to 50 controls at a median age of 18 and 19 years, respectively. The authors observed uroflowmetry patterns, administered questionnaires assessing penile perception scores and ejaculatory concerns, and recorded the position of the urethral meatus while examining whether curvature had recurred. The authors concluded that 39.2% of hypospadias repairs required a reintervention and suboptimal sexual function outcomes were noted in 22.1%. Furthermore, 39% of all proximal hypospadias repairs had recurrent penile curvature of >30 degrees at the time of followup. Unsurprisingly, the higher the number of reinterventions and the more proximal the hypospadias at the start of intervention, the worse the urinary outcome and sexual function.

The authors must be congratulated for embarking on the difficult but extremely necessary task of completing a true long-term observational study despite the inherent difficulties of such endeavors. We are well past the era when short-term surgical outcomes for any type of hypospadias innovation or modification could be considered credible, as a recent study demonstrates that the median time to just the first detection of hypospadias complications approaches 70 months.[1]

Like all well-done studies, this one raises more questions than it alone can answer. This series only included single-stage studies—will 2-stage repairs, now preferred by the authors, fare better? Is an orthotopic urethral meatus as important as a straight erection in defining a "suboptimal outcome?" Would a delay in intervention to 1 year of age deliver better outcomes than repair at 6 months of age? We can only ask for more such methodically completed long-term studies to provide those answers.

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REPLY BY AUTHORS

We would like to thank Dr. Arlen and Dr. Shukla for their constructive comments. We agree with their assessments that, while we tried to address several questions regarding long-term outcomes following hypospadias repair, our results opened the door to many more critical questions that have yet to be answered.

Despite earlier beliefs, hypospadias is not a quick fix condition and requires long-term followup as the neourethra needs to last a lifetime, which can be up to a century in some cases. As we reported previously, multiple reinterventions need to be avoided, given the negative impact on patient psychosexual development and well-being (reference 9 in article). Reintervention rates of 39.2% and suboptimal urinary and/or sexual functional outcomes in 52.9% of cases in our study reflect surgeries that have been performed an average of 16.4 years ago (range 8.2–21.2). New surgical techniques and medical insights will undoubtably decrease complication rates; however, this will only become apparent after a few decades. In order to monitor the impact of newly developed techniques and practices, standardization of patient classification and outcome measures is essential (reference 8 in article). This will allow comparison of outcomes and pooling of data while eliminating as much bias as possible, and could lead to the discovery of patient and surgical factors that are linked to outcomes.

The inclusion of all forms of nonsyndromic hypospadias is a strength of our study as it reflects the entire population encountered in clinical practice. However, it is also an important weakness, as it was impossible to do in-depth analyses in large homogeneous groups. Therefore, we believe that very large cohorts are crucial, which can only be attained through (international) collaboration using large, standardized registries.[1] This will allow the rapid collection of data and recruitment of cases operated within a short time frame using the same surgical methods.

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