Excision and Primary Anastomosis Reconstruction for Traumatic Strictures of the Pendulous Urethra

Nabeel A. Shakir, Joceline S. Fuchs, Nora Haney, Boyd R. Viers, Billy H. Cordon, Maxim McKibben, Jeremy Scott, Noel A. Armenakas, and Allen F. Morey

OBJECTIVES To present a multi-institutional experience with functional and patient-reported outcomes among men undergoing excision and primary anastomosis (EPA) urethroplasty for pendulous urethral strictures.

METHODS We describe the technique and present our experience with EPA for focal penile strictures. Patients undergoing urethroplasty (2004-2017) at 2 tertiary referral centers were reviewed, of whom 14 (0.7%) underwent EPA of radiographically confirmed pendulous urethral strictures. Validated questionnaires were utilized to evaluate overall improvement (Patient Global Impression of Improvement), urinary bother (International Prostate Symptom Score), and sexual function (International Index of Erectile Function-5). Treatment success was defined as urethral patency without need for subsequent reconstruction.

RESULTS Among 14 men undergoing penile EPA, 13/14 (93%) had durable treatment success over a median follow-up of 43 months. No patient reported penile curvature postoperatively. Stricture etiology in most cases was posttraumatic (12/14), of which 4 had a history of urethral disruption secondary to penile fracture and 8 iatrogenic trauma. Median age was 51 years (IQR 30-60) and stricture length 1.0 cm (IQR 1.0-1.4). Erectile function was normal in 8/14 patients preoperatively, and postoperative median International Index of Erectile Function was 21. Most men reported significant global improvement in condition (median Patient Global Impression of Improvement 2, IQR 1-3) and most had only mild urinary bother (median International Prostate Symptom Score 4, quality of life 1). The single treatment failure had a history of hypospadias with multiple prior urethral procedures.

CONCLUSION For men with short strictures of the pendulous urethra, EPA has a high success rate, without adverse sequelae such as erectile function or penile curvature. UROLOGY 125: 234–238, 2018. © 2018 Elsevier Inc.

Excision and primary anastomosis (EPA) is a common reconstructive option for short male urethral strictures involving the bulbar or membranous urethra, offering high success and low complication rates.[1] Traditionally, EPA for strictures involving the pendulous urethra has been contraindicated due to concerns for postoperative chordee, penile shortening and anastomotic tension,[2] despite a paucity of supporting data within the literature.[3-5]

We have observed a subgroup of patients with focal strictures of the penile urethra, potentially amenable to reconstruction using EPA. We hypothesized that EPA urethroplasty could be a viable option for short (1 cm or less), discrete, obliterative pendulous urethral strictures, particularly those of traumatic etiology, and present our technique and experience to date. Transection and excision of focal obliterative strictures allows for complete scar excision, obviating the need for a staged approach or advanced tissue transfer techniques such as buccal mucosal graft or penile skin flap. Further consideration could be given to EPA in men for whom oral mucosal graft may be contraindicated, for example due to oral leukoplakia or tobacco use.[6] To our knowledge, this series represents the first reported cohort of men undergoing EPA for isolated pendulous strictures.

METHODS

Patient Selection

Following Institutional Review Board approval, patients undergoing urethroplasty for pendulous urethral strictures at 2 tertiary referral centers from 2004 to 2016 were reviewed. All patients underwent a thorough preoperative interview including history

Disclosures: *Dr. Allen Morey receives honoraria for being a guest lecturer/meeting participant for Boston Scientific and Coloplast Corp.*
No other authors have disclosures to report.

Address correspondence to: Allen F. Morey, M.D., FACS, 5323 Harry Hines Blvd., Dallas, TX 75390-9110. E-mail: allen.morey@utsouthwestern.edu

https://doi.org/10.1016/j.urology.2018.05.043
0090-4295

Figure 1. Antegrade cystourethrogram demonstrating an obliterative stricture in the midpenile shaft.

of penile fracture, subacute perineal/penoscrotal trauma, and previous catheterization or endoscopic manipulation. Physical exam included assessment of stretched penile length, meatal location and patency, and periurethral tissue quality. Preoperative retrograde urethrogram and voiding cystourethrogram were performed to characterize stricture morphology (Fig. 1). When stricture extent was severe, suprapubic catheter was performed at least 6 weeks to promote more accurate declaration of stricture severity and characteristics.[7]

Stricture etiology, location and length, baseline erectile and urinary function, and prior attempts at correction were documented. Patients were assessed postoperatively with validated questionnaires: International Index of Erectile Function (IIEF), International Prostate Symptom Score (IPSS) and Patient Global Impression of Improvement (PGI-I). Treatment success was defined as pendulous urethral patency without need for additional intervention or reconstruction. Recurrence was defined by patient-reported urinary symptoms confirmed with recurrent stricture or stenosis ≤16F in caliber on cystoscopy.

Surgical Technique

EPA was performed through a midline, longitudinal penoscrotal incision in the supine position. A Lone Star Retractor (Cooper-Surgical, Turnbull, CT) is used for urethral exposure. A beaded, stabilizing strap is positioned behind the base of the penile shaft and a sharp hook is placed inside the meatus at the 12-o'clock position to provide penile traction. The urethra is mobilized circumferentially at the site of stricture and is amputated at the distal-most extent of the stricture as confirmed by bougie sounds and/or flexible cystourethroscopy (Fig. 2).

The distal stump of urethra is mobilized from its attachments to corpora and periurethral tissue. Urethral and spongiosal scar tissue is excised from the distal urethra followed by dorsal spatulation to allow for a 22F calibration with a bougie urethral sound.

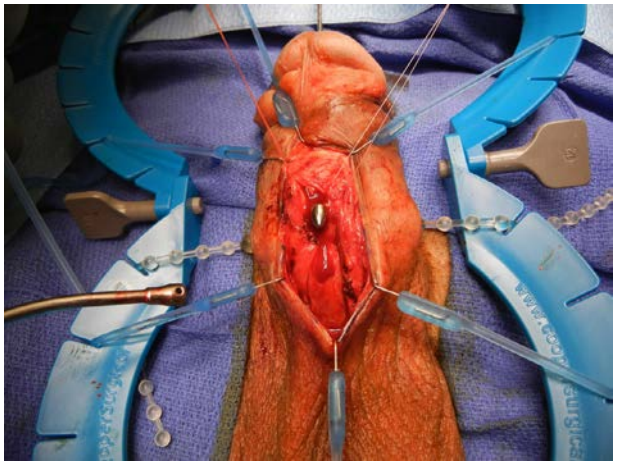

Figure 2. Via longitudinal penoscrotal incision, the urethra is amputated at the distal-most aspect of the stricture. (Color version available online.)

The proximal urethral scar is then excised, followed by mobilization and advancement of the distal bulbar urethra to facilitate a tension-free anastomosis. Penoscrotal urethral mobilization is a vital surgical maneuver to avoid penile tethering and chordee. Proximal ventral spatulation is performed and calibrated to 24F (Fig.3 A,B). Flexible cystourethroscopy is performed to ensure complete stricture excision and to exclude bladder pathology.

A primary anastomosis is performed, starting dorsally. The dorsal, proximal mobilized urethra is anchored to the underlying corporal tunica at the level of the distal urethral stump using interrupted 4-0 Vicryl sutures to ensure a tension-free repair. The dorsal anastomosis is continued laterally to the 3- and 9-o'clock positions with full thickness, interrupted 4-0 Vicryl sutures.

The ventral anastomosis is completed over a 16F silicone urethral catheter in two layers (Fig. 3 C,D). The first layer is comprised of interrupted 4-0 or 5-0 PDS suture, anastomosing urethral mucosa. The second spongioplasty layer reapproximates the outer tunica while preserving the underlying corpus spongiosum vascular channels using 5-0 PDS in a running fashion. Critical to anastomotic urethroplasty is the preservation of corpus spongiosum patency, which provides reconstitution of antegrade urethral blood flow via spongiosal vascular channels. Hemostatic agent (Fibrillar) is then placed periurethrally to minimize surgical site hematoma formation. The incision is closed in multiple layers (deep layers using 2-0 Monocryl, superficial skin using interrupted 3-0 Monocryl). Bacitracin ointment, scrotal fluffs, and scrotal support are applied.

Postoperative Management and Follow-up

Outpatient surgery is the standard in our practice for patients undergoing EPA urethroplasty. The patient is discharged with the urethral catheter to drainage, secured to the lower abdomen in a tension-free manner using a Stat-Lock device. Patients are discharged home with oral analgesics, stool softener, prophylactic antibiotics for the duration of indwelling catheter (we use nitrofurantoin 100 mg daily) and anticholinergic agents for bladder spasms. Urinary catheter removal and voiding cystourethrogram are performed 3 weeks postoperatively to ensure patency and integrity of the repair. Patients are followed clinically at 3 and 6 months postoperatively, and annually thereafter.

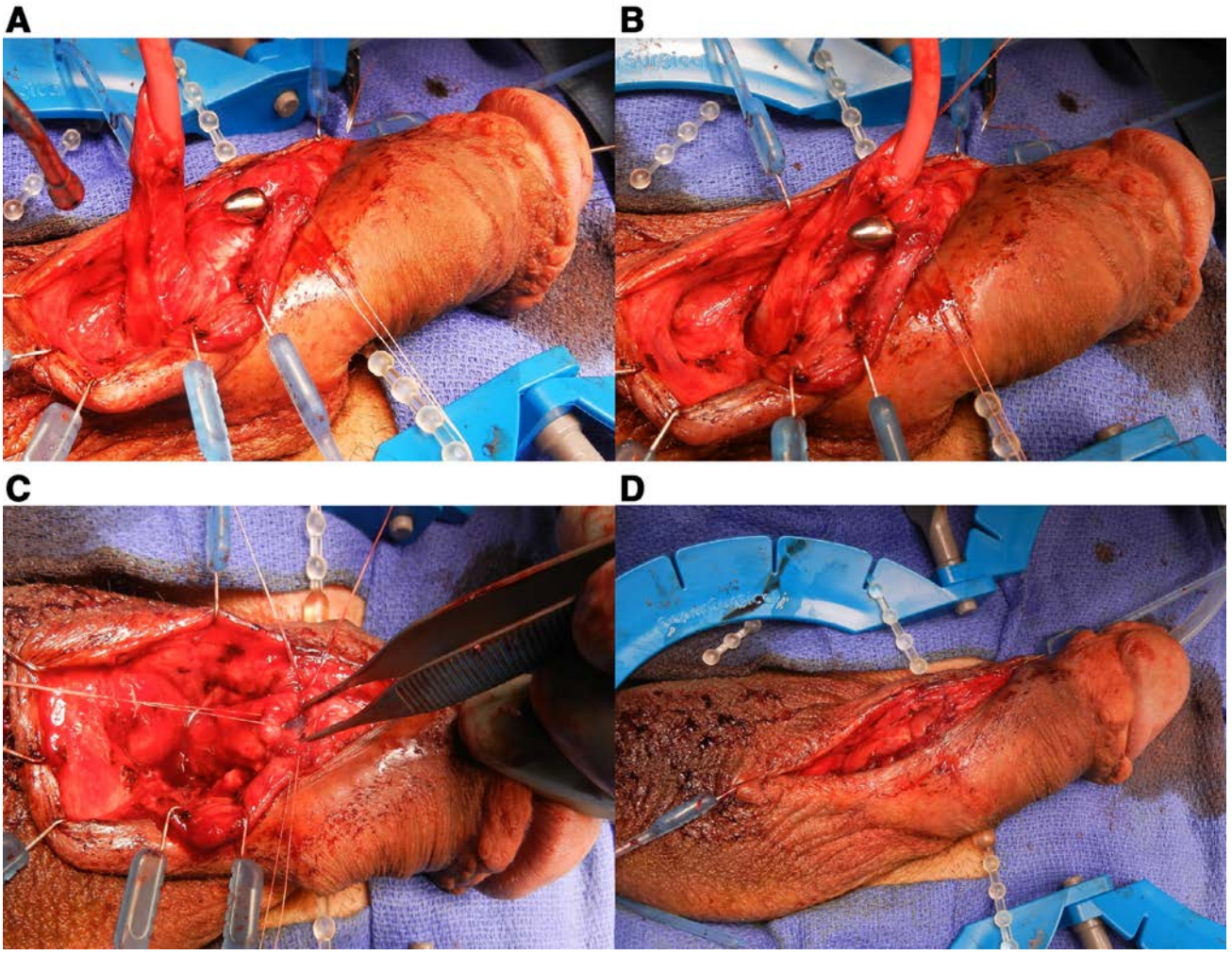

Figure 3. (A) The stricture is excised completely. (B) The proximal and distal urethra are mobilized and calibrated. (C) The proximal urethra is mobilized to facilitate tension free anastomosis. A direct anastomosis is performed, with dorsal fixation and incorporation of corporal tunica. (D) The anastomosis is completed over a 16Fr silicone catheter in two layers ventrally. (Color version available online.)

RESULTS

Urethral Patency

Of patients undergoing urethroplasty at 2 institutions between 2004 and 2016 were reviewed, 14 (0.7%) were identified who underwent EPA for penile strictures. Median age was 51 years (IQR 30-60) and strictures were focal in nature, with a median length 1.0 cm (IQR 1.0-1.4). Patient characteristics and outcomes are presented in Table 1. Most patients (12/14, 85.7%) had history of penile trauma, with either urethral disruption associated with penile fracture (4/12, 33.3%) or iatrogenic injury (8/12, 66.7%). All urethral injuries during penile fracture were repaired acutely via a circumcising approach. The remaining 2 patients (14.2%) had stricture etiology related to a history of hypospadias. Among the 14 men undergoing penile EPA, at a median follow-up of 43 months (IQR 26-121), 13 (92.9%) had durable treatment success. The patient with treatment failure (1/14, 7.1%) had a history of hypospadias and 4 prior failed urethroplasty attempts.

Functional Outcomes

Penile EPA was associated with minimal bother related to urinary symptoms, reliable preservation of erectile function, and improvement in overall urologic condition on patient-reported outcome measures. Patients reported minimal voiding symptoms after urethroplasty, with median IPSS score 4 (IQR 2-14) and quality of life score 1. All patients reported stable erectile function, with median postoperative IIEF score 21 (range 19-25) correlating to either no or mild erectile dysfunction. No patients reported de novo penile curvature, chordee or penile shortening postoperatively. Perceived global improvement was "much better" (median PGI-I score 2, IQR 1-3) after penile EPA, with patients reporting a median overall percentage improvement in symptoms of 85% (IQR 55%-99%). In contrast, the patient with treatment failure had a PGI-I score of 2 and only reported 30% improvement in symptoms postoperatively. Penile strictures resulting from penile fracture with urethral disruption demonstrated similar outcomes to primary strictures

Table 1. Demographic, preoperative, and postoperative characteristics for patients in the cohort. Continuous variables are presented as medians with interquartile ranges (IQR) in parentheses

Parameter	
Number of patients	14
Age, y	51 (30-60)
Erectile dysfunction, no. (%)	4 (29%)
Preoperative penile curvature, no. (%)	0
Stricture etiology, no. (%)	
Hypospadias	2 (14%)
Traumatic/iatrogenic	12 (86%)
Stricture length, cm	1.0 (1.0-1.4)
Follow-up, mo	43 (26-121)
Treatment success, no. (%)	13 (93%)
Patient-reported percentage improvement	85% (55%-99%)
PGI-I†	2 (1-3)
Postoperative IIEF*	21 (19-25)
Postoperative IPSS**	4 (2-14)
Quality of life subscore	1 (0-2)
Postoperative penile curvature, no. (%)	0

* International Index of Erectile Function: 17-21 correlates with moderate ED, 22-25 with no ED.
** International Prostate Symptom Score: 1-7 mild LUTS, 8-19 moderate LUTS.Quality of life subscore: 0 delighted, 1 pleased, 2 mostly satisfied.
† Patient Global Impression of Improvement: 1 very much better, 2 much better, 3 a little better

of the pendulous urethra ($P > .05$ for IPPS, IIEF and PGI-I scores).

DISCUSSION

These data suggest that select patients with focal, obliterative strictures of the proximal pendulous urethra resulting from a traumatic etiology (0.7% of cases within a large tertiary center urethroplasty database) may be appropriate candidates for EPA urethroplasty with a success rate and negligible impact on erectile function or penile cosmesis. Although many have traditionally recommended against EPA for strictures involving the pendulous urethra due to concerns for detrimental effects on erectile function and chordee, the patient-reported outcomes using validated instruments in this series compare favorably to that reported in large series of patients undergoing bulbar urethroplasty.[3,4,8] Critical components to this surgical technique include maintaining antegrade urethral blood flow via a 2-layer spongiosal-sparing anastomosis, and distal bulbar urethra mobilization with overlapping distal advancement to avoid anastomotic tension and penile tethering.

Several key characteristics are used in the pre- and intraoperative judgment of appropriateness for penile EPA urethroplasty and include patient anatomy, tissue elasticity and stricture location. Stretched penile length may correlate with urethral extensibility, and therefore patients with greater stretched penile length may be more amenable to the urethral mobilization required for EPA urethroplasty.[9] While the anatomy of the bulbar urethra does allow for redundancy in mobilization and stricture excision, potentially explaining infrequent reports of chordee following bulbar urethroplasty, the elastic nature of the corpus spongiosum may also contribute.[10] We hypothesize that greater tissue elasticity may be encountered in younger patients without prior intervention, although the ease of intraoperative urethral mobilization was not specifically quantified in this cohort. Ventral spongioplasty as part of a 2-closure further optimizes blood supply at the region of repair, promoting urethral healing and reducing fibrosis and stricture recurrence.[11] We advocate EPA in the mid-to-proximal penile urethra, where the distal bulbar urethra can be adequately mobilized from the penoscrotal area and advanced distally for a tension-free anastomosis without chordee. Outcomes in the distal penile urethra may be less certain.

We propose that EPA urethroplasty should be considered as a primary reconstructive option for the treatment of focal pendulous strictures. The EPA approach may spare patients the morbidity associated with graft urethroplasty, although for longer or more complex pendulous strictures, flap and graft-based techniques are the gold standard. Alternatively, repeated dilations and direct vision internal urethrotomy often delay definitive treatment, may not be feasible for obliterative strictures, and potentially adversely affect surgical reconstruction.[12,13]

All primary fracture-related urethral injuries were repaired via circumcising approach, which we suspect may have limited the exposure needed for optimal urethral mobilization and repair. We have also observed that in the case of urethral injury in the setting of penile fracture, EPA via midline incision is highly effective in stricture identification and adequate proximal urethral mobilization. We have more recently shifted to use of a midline incision at the level of penile fracture for acute repair and are able to expose and repair both the corpora and spongiosum, with no reported subsequent strictures. The exposure afforded by a midline incision is valuable both in the primary traumatic setting as well as for penile EPA urethroplasty.

While this series is limited by a small patient population, this novel report comprises a unique cohort of patients undergoing penile EPA urethroplasty and includes patient-validated quality of life measures (PGI-I) which have not been previously reported. Future studies could incorporate instruments specific to urethroplasty, such as the USS-PROM, which may capture additional preoperative symptoms and be used to gauge postoperative success.[14] Importantly, the results from this pilot series challenge the idea that EPA should not be performed for isolated focal pendulous urethral strictures. The single treatment failure in this series (a patient with history of hypospadias and multiple prior failed repairs) underscores that this approach may not be suitable in a re-operative field with previous mobilization and impaired blood supply.[15] Larger studies are needed to confirm whether the risks of penile shortening, chordee and erectile dysfunction are truly negligible.

CONCLUSION

For select patients with focal traumatic strictures involving the penile urethra, EPA urethroplasty appears to be effective without significant impairment of erectile function or risk of chordee.

References

1. SB B, AF M. *Advanced male urethral and genital reconstructive surgery*. 2nd ed. Humana Press; 2014.
2. Horiguchi A. Substitution urethroplasty using oral mucosa graft for male anterior urethral stricture disease: current topics and reviews. *Int J Urol*. 2017;24:493–503.
3. Webster GD, Koefoot RB, Sihelnik SA. Urethroplasty management in 100 cases of urethral stricture: a rationale for procedure selection. *J Urol*. 1985;134:892–898.
4. Martinez-Pineiro JA, Carcamo P, Garcia Matres MJ, Martinez-Pineiro L, Iglesias JR, Rodriguez Ledesma JM. Excision and anastomotic repair for urethral stricture disease: experience with 150 cases. *Eur Urol*. 1997;32:433–441.
5. Andrich DE. Mundy AR. What is the best technique for urethroplasty. *Eur Urol*. 2008;54:1031–1041.
6. Chapple C, Andrich D, Atala A, et al. SIU/ICUD Consultation on Urethral Strictures: the management of anterior urethral stricture disease using substitution urethroplasty. *Urology*. 2014;83(3 Suppl): S31–S47.
7. Terlecki RP, Steele MC, Valadez C, Morey AF. Urethral rest: role and rationale in preparation for anterior urethroplasty. *Urology*. 2011;77:1477–1481.
8. Erickson BA, Granieri MA, Meeks JJ, Cashy JP, Gonzalez CM. Prospective analysis of erectile dysfunction after anterior urethroplasty: incidence and recovery of function. *J Urol*. 2010;183:657–661.
9. Da Silva EA, Sampaio FJ. Urethral extensibility applied to reconstructive surgery. *J Urol*. 2002;167:2042–2045.
10. Jezior JR. Schlossberg SM. Excision and primary anastomosis for anterior urethral stricture. *Urol Clin N Am*. 2002;29:373–380. vii.
11. Micheli E, Ranieri A, Peracchia G, Lembo A. End-to-end urethroplasty: long-term results. *BJU Int*. 2002;90:68–71.
12. Lubahn JD, Zhao LC, Scott JF, et al. Poor quality of life in patients with urethral stricture treated with intermittent self-dilation. *J Urol*. 2014;191:143–147.
13. Siegel J, Tausch TJ, Simhan J, Morey AF. Innovative approaches for complex penile urethral strictures. *Transl Androl Urol*. 2014;3:179–185.
14. Jackson MJ, Chaudhury I, Mangera A, et al. A prospective patient-centred evaluation of urethroplasty for anterior urethral stricture using a validated patient-reported outcome measure. *Eur Urol*. 2013;64:777–782.
15. Wisenbaugh ES. Gelman J. The use of flaps and grafts in the treatment of urethral stricture disease. *Adv Urol*. 2015;2015 979868.

EDITORIAL COMMENT

Obliterative stricture disease of the pendulous urethra presents a unique technical challenge given the potential for iatrogenic penile curvature if the scarred segment is completely excised. The authors of the manuscript "Excision and primary anastomosis reconstruction for traumatic stricture of the pendulous urethra," should be commended for challenging the dictum that anastomotic repairs are contraindicated for penile urethra strictures.[1] The authors hypothesized that for short strictures in the penile urethra, anastomotic repair would be a safe, feasible alternative to 1- or 2-stage substitution urethroplasty.

The authors' report high success rates using an anastomotic repair in the penile urethra when performed for highly select patients with traumatic or iatrogenic pendulous urethra strictures. The authors stress appropriate patient selection, including adequate stretched penile length and stricture location in the penile urethra, and technical considerations, including a 2-layer closure, when considering the use of an anastomotic repair in the penile urethra. We hope that the importance of these criteria can be further evaluated and defined in future research. However, we agree that the success of the operation likely hinges on the distal advancement of the bulbar urethra in order to limit the possibility for post-operative penile curvature. Thus, this technique should be considered with caution in all but those patients with short strictures limited to the proximal pendulous urethra. Similarly, a failure in 1 of 2 (50%) patients with hypospadias-related stricture warrants caution as a 2-stage approach may be better suited when obliteration of the urethral plate is identified.[2]

The limited applicability of excision and primary anastomosis for pendulous urethral strictures is underlined by the author's utilization in only 0.7% of patients in their contemporary urethroplasty database. However, the authors have demonstrated the feasibility of this technique in appropriately selected patients. Further studies in the future with undoubtedly provide greater detail about appropriate patient selection for the use of anastomotic repairs in the penile urethra.

Kyle Scarberry, Jonathan E. Kiechle, Urology Institute, University Hospitals Cleveland Medical Center, Cleveland, OH; Case Western Reserve University School of Medicine, Cleveland, OH; Aurora Health Care, Milwaukee, WI
E-mail: jkiechle@gmail.com (J.E. Kiechle).

References

1. Hagedorn JC, Voelzke BB. Patient selection for urethroplasty technique. *Urol Clin N Am*. 2017;44:27–37.
2. Morrison CD, Cinà DP, Gonzalez CM, et al. Surgical approaches and long-term outcomes in adults with complex reoperative hypospadias repair. *J Urol*. 2018;199:1296–1301.

https://doi.org/10.1016/j.urology.2018.05.046
UROLOGY 125: 238, 2018.