

Urethral Rest: Role and Rationale in Preparation for Anterior Urethroplasty

Ryan P. Terlecki, Matthew C. Steele, Celeste Valadez, and Allen F. Morey

OBJECTIVES	To report the outcomes of men treated initially with a period of urethral rest to allow tissue recovery before anterior urethroplasty. Many men referred to referral centers for anterior urethral reconstruction often present soon after the endoscopic manipulation of severe strictures.
METHODS	We reviewed our database of all anterior urethroplasties performed by a single surgeon from 2007 to 2009. Urethral rest was accomplished by removal of the indwelling catheter, cessation of self-catheterization, and/or suprapubic urinary diversion before urethral reconstruction.
RESULTS	During the study period, 210 patients underwent urethral reconstruction at our center. Men who had undergone meatoplasty or posterior urethroplasty were excluded, leaving 128 anterior urethroplasty patients available for analysis. Of these men, 28 (21%) were preoperatively given an initial period of urethral rest (median duration 3 months) because of recent urologic manipulation occurring immediately before referral. Of the 28 patients, 15 (54%) received suprapubic catheters. Urethral rest promoted identification of severely fibrotic stricture segments, enabling focal or complete excision in 75% (excision and primary anastomosis in 12 [43%] and augmented anastomosis in 9 [32%]), a percentage similar to that for those undergoing reconstruction without preliminary manipulation mandating urethral rest (82%). Stricture recurrence developed in 4 (14%) of the 28 rest patients, a rate again similar to that for the remainder of the urethroplasty population (10%).
CONCLUSIONS	The results of our study have shown that recently manipulated anterior urethral strictures often declare themselves to be obliterative within several months of urethral rest, thus enabling successful urethroplasty by focal or complete excision. UROLOGY 77: 1477–1481, 2011. © 2011 Elsevier Inc.

Men referred to tertiary care centers for definitive management of urethral strictures often present immediately after the endoscopic intervention, either with an indwelling Foley catheter in place or while actively engaged in a regimen of self-catheterization. Because urethral dilation profoundly alter the stricture characteristics, the rational determination of the appropriate care by the accepting physician is often rendered impossible. Little guidance is currently available in the urologic data pertaining to the timing of urethroplasty after anterior urethral instrumentation.

We have routinely implemented a period of “urethral rest” for patients with recent instrumentation, with or without suprapubic urinary diversion, to encourage tissue recovery and promote the accurate radiographic depiction of the extent of the urethral pathologic findings as a guide for surgical decision making. The benefits of a

several-month period of urethral rest after pelvic fracture-related urethral distraction injuries have been well documented as a prelude to successful posterior urethral reconstruction.¹ The present report, to our knowledge, is the first to examine the role and rationale of urethral rest in promoting successful anterior urethral reconstruction.

MATERIAL AND METHODS

Patient Selection

We reviewed a consecutive series of all urethroplasties performed by a single surgeon (A.F.M.) at our referral center from 2007 to 2009. Only men undergoing reconstruction of anterior urethral strictures were included; those undergoing meatoplasty or posterior urethroplasty were excluded. The University of Texas Southwestern Medical Center institutional review board approved and provided oversight for the present review. The patient data were retrospectively reviewed, and quality checks were performed periodically to ensure the accuracy and completeness of the data.

Urethral Rest as Initial Phase of Reconstruction

Men who have undergone recent urethral instrumentation before tertiary referral (defined as <1 month before presentation) who were catheter dependant at presentation were deemed to

From the Department of Urology, Wake Forest University School of Medicine, Winston-Salem, North Carolina; University of Virginia Medical Center, Charlottesville, Virginia; and Department of Urology, University of Texas Southwestern Medical Center, Dallas, Texas

Reprint requests: Allen F. Morey, M.D., Department of Urology, University of Texas Southwestern Medical Center, Moss Building, 8th Floor, Suite 112, 5323 Harry Hines Boulevard, Dallas, TX 75390-9110. E-mail: Allen.morey@utsouthwestern.edu

Submitted: November 10, 2010, accepted (with revisions): January 21, 2011

have unstable strictures. Initial management with a period of urethral rest was instituted to allow tissue recovery and stricture maturation as a guide for reconstructive decision making. Thus, indwelling urethral catheters, when present, were removed on the day of the initial consultation and patients using active regimens of self-catheterization were instructed to discontinue this practice immediately in preparation for delayed urethroplasty. Finally, suprapubic tube urinary diversion (SPT) was performed promptly in those with concern of impending retention—this strategy was encouraged on the basis of written endoscopic reports from the referring urologist, alluding to stricture severity and/or patient complaints of a recurrent marked decrease in urinary stream soon after recent dilation. Some men were offered SPT placement but refused, opting instead to risk the exacerbation of voiding symptoms while waiting for their scheduled urethroplasty. Patients with stable strictures who had undergone remote instrumentation but who were not catheter dependant at referral were excluded from the urethral rest group.

Men treated with initial urethral rest returned for urethrography 2 months later. A discussion of the radiographic findings and surgical counseling were performed at that time, and urethroplasty was conducted 1 month later, 3 months after urethral rest had been initiated. The SPT catheters were exchanged either after 2 months or at urethroplasty to prevent stone formation.

Statistical Analysis

Failure was defined as the need for any postoperative intervention for symptomatic stricture recurrence, similar to that of other recently published series.^{2,3} Follow-up evaluations were conducted by one of us (A.F.M.) and/or the referring urologist at 6- and 12-month intervals with American Urological Association symptom scores and flow rates. The patients were specifically queried regarding voiding patterns, continence, and sexual problems. All men with evidence of symptom recurrence underwent prompt examination both radiographically and endoscopically. All patients with <12 months of follow-up were excluded.

The patients with and without urethral rest were compared using Fisher's exact test, independent sample *t* tests, and the Mann-Whitney *U* test for categorical variables, normally distributed continuous variables, and non-normally distributed continuous variables, respectively. Statistical significance in the present study was set at $P \leq .05$, and reported *P* values are 2-sided. All analyses were performed using the Statistical Package for Social Sciences, version 17.0 (SPSS, Chicago, IL).

RESULTS

Demographics

Of the 210 men who underwent urethral reconstruction at our center during the study period, 128 with complete data who had undergone anterior urethroplasty were included in the present analysis. Of these, a surprisingly high number, 28 (21.9%) had undergone urologic instrumentation just before referral and warranted a period of urethral rest before reconstructive surgery. Of the 28 urethral rest patients, 15 (54%) received SPT placement; the remaining 13 were voiding adequately without requiring urgent instrumentation while waiting for urethral



Figure 1. Retrograde urethrogram of patient 6 weeks after removal of 16F catheter that had been repeatedly exchanged during 2-year period after blunt urethral trauma. SPT urinary diversion was performed in conjunction with Foley catheter removal. Patient ultimately successfully underwent augmented anastomotic urethroplasty involving focal excision, dorsal reanastomosis, and ventral buccal mucosa graft onlay.

reconstruction. Of the 15 patients with SPT diversion, 11 (73%) underwent SPT placement at our center immediately after the initial consultation and 4 (27%) had undergone SPT placement before referral owing to the severity of their voiding complaints and/or stricture complexity. The duration of urethral rest before reconstruction was 3 months.

Radiographic and Operative Findings

Urethral rest reliably promoted distinct radiographic identification of the stricture extent and location by the second month (Fig. 1). Severely fibrotic stricture segments were identified in most cases, prompting focal or complete stricture excision in 21 (75%) of the 28 patients. The most common urethroplasty techniques performed for the urethral rest patients were excision and primary anastomosis (EPA) in 12 patients (43%). Stricture excision with dorsal anastomosis and ventral graft onlay (augmented anastomosis) was performed in 8 patients (29%); 1 patient developed a long obliterative stricture after catheter removal, requiring distal urethral excision with staged graft reconstruction. Graft or flap ventral onlay was performed in 7 patients (25%). The median stricture length overall was 3 cm (range 1-16.5), and the median follow-up was 636 days.

Of the 100 patients undergoing anterior urethroplasty without urethral rest, 82% had focal or complete stricture excision (67 EPA and 15 dorsal plate resection with augmented anastomosis); 18 underwent ventral flap or graft onlay alone. The median stricture length was 2.5 cm (range 1-14), and median follow-up was 641 days.

Outcomes Analysis

Stricture recurrence was seen in 14% of the urethral rest patients, a rate similar to the 10% recurrence rate for the urethroplasty patients who did not require urethral rest. A comparison of both groups revealed no significant differences in stricture length, the need for excisional

therapy, follow-up, or recurrence ($P > .05$), indicating that urethral rest effectively allowed tissue recovery, which promoted appropriate procedure selection and successful reconstruction using a standardized surgical approach. Recurrent strictures tended to be associated with previous urethral dilation and were less likely to have been managed with a suprapubic catheter preoperatively ($P > .05$).

COMMENT

Wound Healing Principles as Rationale for Urethral Rest

Urethral rest initiates a process of tissue stabilization that mimics the normal wound healing processes occurring elsewhere in the body after injury. Wound healing is known to occur by way of 3 overlapping phases—inflammation, proliferation, and remodeling.⁴ The initial inflammatory phase, beginning at injury and lasting through days 4-6, is precipitated by the exposure of collagen, which activates the clotting cascade.⁵ The proliferative phase, occurring between days 4 and 14, ends with the formation of granulation tissue and the development of wound contraction. The third phase, remodeling, can continue for 1 year after injury and results in formation of a persistent scar that will never be as elastic as uninjured tissue.

For the reconstructive urologist, catheter removal initiates the process of tissue remodeling—this produces a natural collapse of the strictured lumen, allowing identification of the location and severity of the pathologic process. Our rationale for implementing a urethral rest duration of 3 months was that it appears to allow for wound (stricture) contraction in accordance with completion of the inflammatory and proliferative phases of wound healing, although the degree of remodeling that might occur during an additional rest period is unknown. Because the key steps of wound healing are orchestrated by the subepithelial extracellular matrix, the endoscopic appearance of the urothelium alone might not reflect the degree of underlying spongiositis, which often extends beyond the presumed boundaries of stricture involvement at surgery.⁶⁻⁹

We believe that each urethral dilation represents a newly induced iatrogenic injury, with each event reinitiating the wound healing process. Multiple treatments before urethroplasty represent an established risk factor for stricture recurrence and stricture extension.¹⁰⁻¹² Programs of self-catheterization and dilation not only inconvenience patients, but also put them at risk of traumatizing both the involved and uninvolved segments of the urethra.¹³ Repetitive endoscopic stricture treatments have been shown to be both costly and futile but remain commonplace.^{14,15} Despite the greater risk of recurrence in patients with unstable and severe strictures referred to our institution with indwelling catheters or actively self-catheterizing, an initial period of urethral rest seemed to enable a standardized surgical approach with excellent

outcomes similar to those for men presenting with stable, unmanipulated anterior urethral strictures.

Facilitating Proper Selection of Urethroplasty Technique

The selection of an appropriate urethroplasty technique requires accurate radiographic staging of the stricture. Our findings have confirmed the previous observations of Jordan and Schlossberg,¹⁶ who suggested that the urethra proximal to a narrowed area might be destined for constriction and should declare itself after 6-8 weeks of suprapubic diversion. We were surprised by the frequency and rapidity with which recently instrumented strictures became obliterative during a brief period of rest and the high number requiring an excisional surgical approach (Fig. 2). Even patients presenting with a longstanding indwelling catheter often manifested significant collapse of the urethral lumen soon after catheter removal. Our experience has indicated that tissue remodeling (luminal contracture) occurs early after the initiation of urethral rest and that imaging findings obtained after 8 weeks of urethral rest correlated closely to the location and severity of strictures identified intraoperatively thereafter.

The success of EPA urethroplasty, widely considered the reference standard, is based primarily on the identification and complete removal of fibrosis, thus allowing preservation and reapproximation of the surrounding healthy tissue.^{3,17,18} Obliterative strictures too long for EPA will be better served by an augmented anastomotic approach incorporating focal excision with graft application extending well into the normal tissue at each end of the repair.¹⁹ These data illustrate the value of an initial period of tissue recovery of several months' duration to allow the natural history of the stricture to manifest itself before undertaking surgery.

Value of Suprapubic Diversion

Many men referred for anterior urethroplasty presented with indwelling urethral catheters because they had failed ≥ 1 voiding trials and could not safely be rendered catheter free before referral. In other cases, difficult dilations or urethrotomies were performed just before referral, despite the extreme density of these strictures. Very few patients with severe strictures were referred with a SPT already in place—those who did were already deemed to be “catheter dependent” because of having severely bothersome voiding dysfunction with urinary infection and/or retention. Patients with moderate voiding symptoms who were not initially diverted did not tend to require delayed SPT during the brief urethral rest interval leading up to their reconstruction.

Our policy to remove urethral catheters as soon as possible after tertiary referral appears to be well substantiated. Prolonged urethral catheterization complicates healing because of multiple mechanisms, thus possibly explaining why the overwhelming majority of strictures in the present series became obliterative after catheter

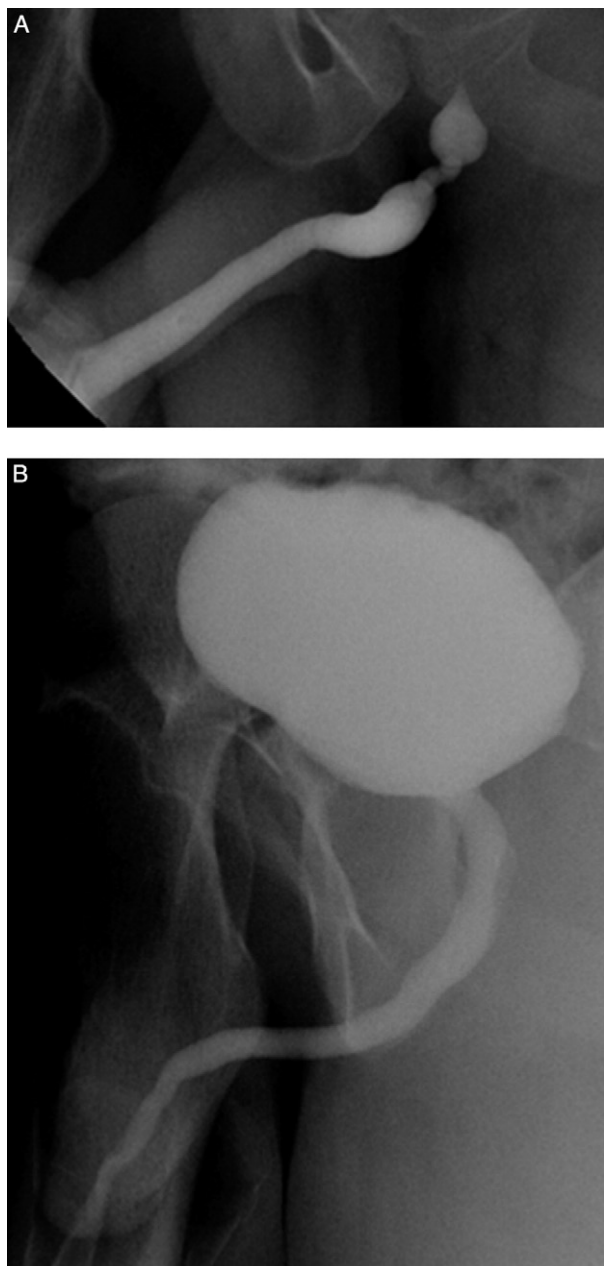


Figure 2. (A) Retrograde urethrogram of patient with history of multiple failed endoscopic procedures, who presented with indwelling catheter immediately after urethral dilation for acute urinary retention. Urethrogram shows 2-cm stricture nearing obliteration 6 weeks after catheter removal. **(B)** Voiding cystourethrogram from same patient 3 weeks after anastomotic urethroplasty revealing widely patent urethral lumen.

removal. Bacteria found in the catheter biofilm prolong the inflammatory phase and interfere with wound contraction.⁴ Bacterial endotoxins lead to the release of collagenase, which can destroy the surrounding, previously normal tissue. Although most urine flows through the catheter lumen, stenting of the bladder neck allows urine to also travel along the outside of the catheter, with potential urinary extravasation adding inflammatory insult to the periurethral tissues. Urine damages the under-

lying interstitium largely by the toxic concentration of potassium.²⁰ Apart from the mechanical irritation and inflammation, increased mural pressure from indwelling urethral catheters can produce relative tissue ischemia and development of a wound milieu that upregulates contraction.^{7,21}

We acknowledge that SPT urinary diversion, even when temporary, carries associated risks of infection, pain, calcification, and abdominal visceral injury. Furthermore, most men are reluctant to accept SPT when initially offered because of fear or the anticipated detrimental effect on their daily activities. However, these risks must be balanced against the potential pitfalls of the continuation of impaired high-pressure voiding and the delay caused by urethral manipulation before referral. Supraphysiologic voiding pressures proximal to a stricture can play a role in extending the disease through both inflammatory and mechanical forces by way of a “water hammer” effect.^{7,22} Numerous investigators have noted proximal urethral hydrodilation to be associated with the development of unfavorable histologic changes and proximal extension of pathologic findings within the extracellular matrix.⁸ Not surprisingly, such alterations have been less common among patients with a SPT for ≥ 30 days before EPA.⁷

Routing urine away from a urethral defect to avoid mechanical irritation is a time-honored, yet underappreciated, concept.²³⁻²⁵ Although in developing countries, SPT diversion has long been performed as a part of the initial management of advanced inflammatory sequelae of untreated strictures, our experience reflects the growing problem of persistent, unhelpful urologic instrumentation of significant strictures that have not yet resulted in abscess or fistulation. Among a similar group of men with anterior urethral trauma, Park and McAninch²⁶ found that SPT placement increased the chance of undergoing EPA repair instead of complex urethroplasty with tissue transfer, which was required more often after transurethral manipulation. In the management of pelvic fracture urethral distraction defects, the concern of extending the inflammation and fibrosis by realignment has led most experts to recommend 3 months of SPT diversion before EPA.¹ Recently, the beneficial effects of SPT diversion have even been noted after radical prostatectomy. Krane et al²⁷ reported that using SPT diversion after robotic radical prostatectomy instead of the traditional urethral catheter appeared to prevent anastomotic stricture formation.

Our favorable experience with early SPT diversion suggests that this strategy has been underused in the treatment of urethral strictures. For severe strictures, the security and dramatic symptomatic relief provided by SPT seem to be far preferable to the obligatory self-catheterization regimens and to far outweigh the negligible risk. Moreover, SPT initiates a rapid and salubrious tissue recovery within the strictured segment that appears to promote optimal urethroplasty outcomes.

Future Considerations

Stricture severity is a key consideration in selecting the appropriate method of anterior urethral reconstruction. Our study is the first to quantify the role of urethral rest and assess its effect in promoting successful anterior urethroplasty outcomes. However, our study was limited by its retrospective nature and short duration. Although the rationale for a 3-month rest period appears to be sound, the optimal duration of the diversion remains unknown. Prospective histopathologic correlation with radiographic changes would likely provide additional insight into the biologic foundations of these observations. Finally, although our experience suggests that SPT diversion elicits a rapid collapse of strictures that expedites their identification and repair, the degree and time with which the tissue changes occur is unknown compared with simple catheter removal and cessation of self-catheterization alone.

CONCLUSIONS

Patients and community urologists should recognize that transurethral instrumentation of severe strictures often mandates a significant recovery phase of several months' duration before embarking on definitive repair; dilation procedures should therefore be avoided when success is unlikely.

For patients presenting to tertiary referral centers soon after urethral manipulation, urethral rest appears to be a valuable first step toward completion of successful urethroplasty. Radiographic delineation of unstable urethral pathologic features occurs as a result of tissue remodeling, a process that allows accurate determination of stricture severity. Strictures that have been recently manipulated often declare themselves to be obliterative, thus requiring focal or complete excision, rather than a straightforward onlay procedure. Early SPT followed by prompt open urethroplasty should be considered in men with severe strictures to prevent the unnecessary costs, delays, and tissue injuries associated with unhelpful endoscopic treatment.

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