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Authors
Zaid, UB
Hawkins, M
Wilson, L
et al.

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The Cost of Surveillance After Urethroplasty

Uwais B. Zaid, Mitchel Hawkins, Leslie Wilson, Jie Ting, Catherine Harris, Amjad Alwaal, Lee C. Zhao, Allen F. Morey, and Benjamin N. Breyer

OBJECTIVE To determine variability in urethral stricture surveillance. Urethral strictures impact quality of life and exact a large economic burden. Although urethroplasty is the gold standard for durable treatment, strictures recur in 8%-18%. There are no universally accepted guidelines for posturethroplasty surveillance. We performed a literature search to evaluate variability in surveillance protocols, analyzed costs, and reviewed performance of each commonly used modality.

METHODS MEDLINE search was performed using the keywords "urethroplasty," "urethral stricture," and "stricture recurrence" to ascertain commonly used surveillance strategies for stricture recurrence. We included English language articles from the past 10 years with at least 10 patients, and age >18 years. Cost data were calculated based on standard 2013 Centers for Medicare and Medicaid Services physician's fees.

RESULTS Surveillance methods included retrograde urethrogram or voiding cystourethrogram, cystourethroscopy, urethral ultrasound, American Urological Association Symptom Score, and postvoid residual and urine flowmetry (UF) measurement. Most protocols call for a retrograde urethrogram or voiding cystourethrogram at the time of catheter removal. After this, UF or PVR, cystoscopy, urine culture, or a combination of UF and American Urological Association Symptom Score was performed at variable intervals. The first-year follow-up cost of anterior urethral surgery ranged from $205 to $1784. For posterior urethral surgery, follow-up cost for the first year ranged from $404 to $961.

CONCLUSION Practice variability for surveillance of urethral stricture recurrence after urethroplasty leads to significant differences in cost. UROLOGY 85: 1195–1199, 2015. © 2015 Elsevier Inc.

Urethral strictures negatively impact quality of life and exact a large economic burden.[1,2] It is more prevalent in historically vulnerable and underserved patients including older men, African Americans, and inner city populations.[1] In addition to lower urinary tract symptoms and recurrent urinary tract infections, long-standing obstruction may lead to more severe sequelae such as detrusor dysfunction, renal failure, urethral carcinoma, and Fournier gangrene.[1,3,4] Annual expenditure for treatment of urethral stricture disease in 2000 was estimated to be $191 million, most of which was due to outpatient surgery visits.[1]

Open urethral reconstruction is considered a durable and definitive treatment for urethral stricture with lifetime success rates ranging from 75% to 100%.[5] Strictures may recur long after urethroplasty.[5] Consequently, long-term surveillance for stricture recurrence after urethroplasty is an essential component of disease management.

Despite the availability of multiple surveillance options, there is no standard surveillance modality or regimen for stricture recurrence after urethroplasty.[5-8] There are many surveillance modalities with a wide range of cost, availability, invasiveness, and risk of complications. These include history and physical with the use of a validated questionnaire such as the American Urological Association–International Prostate Symptom Score, urine analysis (UA) and urine culture (UCx), postvoid residual (PVR) ultrasound (US), uroflowmetry (UF), urethral US via penile or urethral US, retrograde urethrogram (RUG), voiding cystourethrogram (VCUG), urethral calibration, and flexible cystoscopy.[5,8] Additionally, these modalities are used in varying combinations in a multitier process.[5]

To characterize the cost of urethral stricture surveillance, we performed a survey of the literature to delineate commonly used surveillance modalities and surveillance regimen by stricture type and repair type; we performed a comparison of charges for each individual modality and surveillance regimen as a marker for cost, a description of

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From the Department of Urology, University of California, San Francisco, San Francisco, CA; the Department of Pharmacy, University of California, San Francisco, San Francisco, CA; the Department of Urology, New York University, New York, NY; and the Department of Urology, University of Texas Southwestern Medical Center, Dallas, TX

Address correspondence to: Benjamin N. Breyer, M.D., M.A.S., Department of Urology, University of California, San Francisco, 400 Parnassus Ave., A610, San Francisco, CA 94143. E-mail: bbreyer@urology.ucsf.edu

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potential complications of select surveillance modalities, and a review of the sensitivity and specificity of select surveillance regimen.

METHODS

A MEDLINE or PubMed search of the published literature for "urethroplasty," "urethral stricture," and "stricture recurrence" was performed to ascertain commonly used surveillance strategies for stricture recurrence in patients who had undergone open urethral reconstruction for urethral stricture disease. All English language articles published in peer-reviewed journals from 2003 to 2012 were included in our analysis. Inclusion criteria were original articles with at least 10 patients, age >18 years, and those who included a detailed description of the surveillance regimen used for at least 1 year after surgery. We included all types of urethral strictures and repairs in our evaluation. Exclusion criteria included studies with pediatric and female patients, genitoplasty, review articles, studies focusing on erectile dysfunction after urethroplasty, and studies that did not delineate a surveillance protocol. We abstracted the surveillance regimen and modalities used, type of stricture, type of repair, number of patients, and follow-up period.

Cost data of individual procedures and level 3 office visits were extrapolated from charges from the standard 2013 nonfacility fee obtained from the Centers for Medicare and Medicaid Services (Web site: www.CMS.gov). The costs of urine culture and urine analysis were based on the usual customary and reasonable fee at the 50th percentile. Costs for surveillance regimen were a summation of charges from each individual component. Office visits were presumed to be a level 3 visit. The initial visit for catheter removal was presumed to be covered under the global cost of surgery, and thus, nonprocedure office visit costs were not included in the cost analysis; however, procedures performed were included in the final cost analysis.

Descriptive statistics were used (Microsoft Excel, version 14.1.0 [2011]; Redmond, Washington,). Additionally, the chi-square test was used to determine significance in cost by stricture type using GraphPad Prism (version 5.00; GraphPad Software Inc, La Jolla, CA).

RESULTS

Study Characteristics

Supplementary Figure 1 details our literature search. From our initial literature search, we identified 559 potential studies for inclusion. Of these, 474 were excluded because they either included female or pediatric patients (258 studies); did not address surveillance, urethral strictures, or recurrence after urethroplasty (171 studies); had <10 patients (36 studies); or included transgender patients undergoing nonurethral stricture surgery (9 studies). Of the remaining 85 studies, 41 were excluded because they did not clearly delineate a surveillance regimen that spanned from catheter removal to at least 1 year after surgery. We included a total of 44 studies in our final analysis.

Supplementary Table 1 lists study characteristics. The number of patients per study ranged from 11 to 206, and follow-up ranged from 5 to 97 months. Studies most commonly examined anterior urethral strictures (37 of 44 [84.1%]).

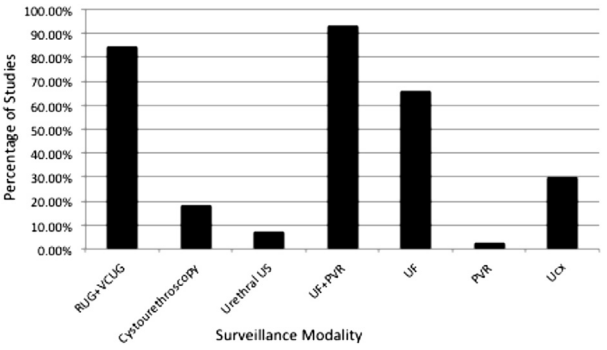

Figure 1. Percentage of studies performing each surveillance modality (n = 44). Urine flowmetry (UF) or postvoid residual (PVR) or a combination was used in 41 of 44 patients (93.2%) as part of their regimen. More specifically, only 29 of 44 patients (65.9%) used UF, 11 of 44 (25%) used both PVR and UF, and 1 of 44 (2.2%) used PVR only. Urine culture was used in 13 of 44 studies (29.5%). Cystourethroscopy was performed in 8 of 44 patients. Urethral ultrasound was performed in 3 of 44 patients (6.8%). PVR, postvoid residual; RUG, retrograde urethrogram; UCx, urine culture; UF, urine flowmetry; US, ultrasound; VCUG, voiding cystourethrogram.

Surveillance Modalities

Commonly used surveillance modalities included symptom evaluation, UA, UCx, UF, PVR, RUG, VCUG, cystourethroscopy, and US. One study performed urethral calibration routinely as part of surveillance regimen. This was a single-stage reconstruction of complex anterior urethral strictures. Calibration was with a 16F catheter.[9,10] A total of 37 of 44 patients (84.1%) performed an RUG or VCUG at the time of catheter removal, which typically was 2-4 weeks after surgery. Figure 1 lists the frequency by which each surveillance modality was performed. Imaging, symptom evaluation, and UF or PVR were used in different frequencies. This ranged from as frequent as every month to annually.

Surveillance Charges

Charges derived from the Centers for Medicare and Medicaid Services data for individual modalities are listed in Table 1. Cystourethroscopy costs $202, RUG with interpretation is $124, VCUG with interpretation is $271, US is $110, UCx is $41, UA is $16, UF is $16, PVR is $20, and a level 3 office visit is $73.

With available data, we were able to calculate charges from the first year of surveillance (Fig. 2). When available, we extrapolated charges to 5 years. This was available for 28 of 44 studies. Supplementary Table 1 lists charges of each surveillance regimen. Table 2 lists charges of the first year of surveillance by stricture type. For surgeries due to anterior urethral strictures, the first year ranged from $205 to $1784. Average was $777 ± 395 and median was $660. Five-year charges ranged from $844 to $4494. Average charge was $1397 ± 834 and median was $1069. For posterior urethral surgery, charges for the first year ranged from $404 to $961. Average charge was

Table 1. Costs of individual screening modalities

Procedure	CPT Code	Nonfacility Fee ($)*
Cystourethroscopy	52000	202
Retrograde urethrogram	51610	107
RUG interpretation	74420-26	18
Voiding cystourethrogram	51600	185
VCUG interpretation	74455	87
Urethral ultrasound	76705	110
Urine culture†	87086	41
Urine analysis†	81003	16
Uroflowmetry complex	51741	16
Postvoid residual	51798	20
IPSS survey‡		0.5
Office visit level 3	99213	73
Antibiotics levofloxacin 500 mg orally × 1 dose (for RUG/VCUG, cystoscope)	AWP $19.26 for 50 units (minus 16%)	0.32

AWP, average wholesale price; CPT, Current Procedural Terminology; IPSS, International Prostate Symptom Score; RUG, retrograde urethrogram; VCUG, voiding cystourethrogram.
* Physician fee schedule from Centers for Medicare and Medicaid Services (Web site: www.CMS.gov).
† 50th customary and reasonable cost percentile.
‡ Cost of International Prostate Symptom Score and IESS survey obtained from Belsante et al, 2013.

$724 ± 259 and median charge was $800. Five-year charge was available only for 1 study and was $1286. Most of the charges were accumulated during the first year of surveillance. When comparing anterior vs posterior urethral strictures, the charges of surveillance for the first year were not statistically significant ($P = .76$).

COMMENT

There is significant practice variability and cost for surveillance of urethral strictures. The first-year charges of anterior urethral stricture surveillance, for instance, ranged from $205 to $1784. Cost-effective research and practices are now emphasized to mitigate rising health care costs.[11] Studies have demonstrated that urethroplasty is not only a more durable treatment but it is also more cost effective than direct vision internal urethrotomy in the management of short bulbar urethral strictures. In spite of its relatively high success rate, there is a risk for stricture recurrence. The optimal regimen for routine surveillance after urethroplasty has not been established.[5] Furthermore, the optimal intensity and frequency of follow-up is not known.

In addition to cost, it is essential to consider the risks of each modality. For instance, complications after cystourethroscopy include symptomatic urinary tract infection in 1.8%-10% of patients.[12-18] Per the American Urological Association's Best Practice Policy Statement on Urologic Surgery Antimicrobial Prophylaxis,[19] patients with "anatomic anomalies of the urinary tract" or "advanced age" should receive periprocedural antibiotics at the time of cystourethroscopy. The additional costs of antibiotics, allergic reactions, and bacterial resistance should be considered.[14] With RUG and VCUG, one needs to consider the discomfort of catheter placement and exposure to radiation. No adverse events have been reported in the literature with symptom evaluation, UF or PVR.

Study Performance

The test characteristics of UF, penile US, and RUG to detect stricture recurrence are reviewed in Supplementary Table 2. The sensitivity of UF compared with RUG or VCUG increases as flow rate increases and specificity increases as flow rate decreases. Per Erickson et al, sensitivity increases to 92% with flow rates <20 mL/s and specificity increases to 93% with flow rates <10 mL/s. The positive predictive value is 73% with flow rates <10 mL/s and negative predictive value is 96% with flow rates <20 mL/s.[20,21] Choudhary et al compared US vs RUG with intraoperative confirmation of stricture. With RUG and US, sensitivity increased as stricture length increased, and specificity generally was high for all stricture lengths.[22] Cystoscopy is traditionally used as the gold standard for determination of urethral stricture and is presumed to provide 100% sensitivity and specificity.[5] PVR measurement has not been independently validated in urethral stricture disease.[5]

We advocate for a risk-stratified model, where surveillance is tailored to the patient. Similar to principles used in oncology, where higher risk patients undergo more extensive surveillance, patients with risk factors that predict a greater risk for recurrence should have a more rigorous surveillance regimen. In an approach described by Belsante et al,[11] in a symptom-based risk-stratified protocol, patients considered low risk after end primary anastamosis were followed up with symptom scores, and as needed, follow-up appointments vs standard risk patients were followed up with symptom scores, UF every 3 months for the first year, and an RUG at 3 and 12 months. With this tailored approach, they demonstrated a 5-year cost of risk-stratified surveillance of $430 vs $2827 using standard follow-up strategies with a nationwide cost savings of $11 million dollars over 5 years.[11] This approach would ideally target those patients at greatest risk for recurrence and those who would benefit most from closer surveillance.

Our study has several limitations. The protocols evaluated were from research studies, which may not mirror real-life practices. Most studies do not comment on patient compliance with follow-up, which may differ among referral centers. Additionally, of 559 studies evaluated, only 44 described detailed surveillance modalities. This may introduce an element of bias in our analysis. We used the 2013 Medicare costs, which may not be accurate, and we have not factored in the cost of travel and lost time from work for various follow-up regimens. The most important weakness of the study is that it is unknown whether surveillance of asymptomatic patients after urethroplasty has any benefit. In oncology, the goal of a surveillance regimen is to identify recurrences earlier so that earlier treatment can be initiated, with the assumption that early treatment is more likely to be successful

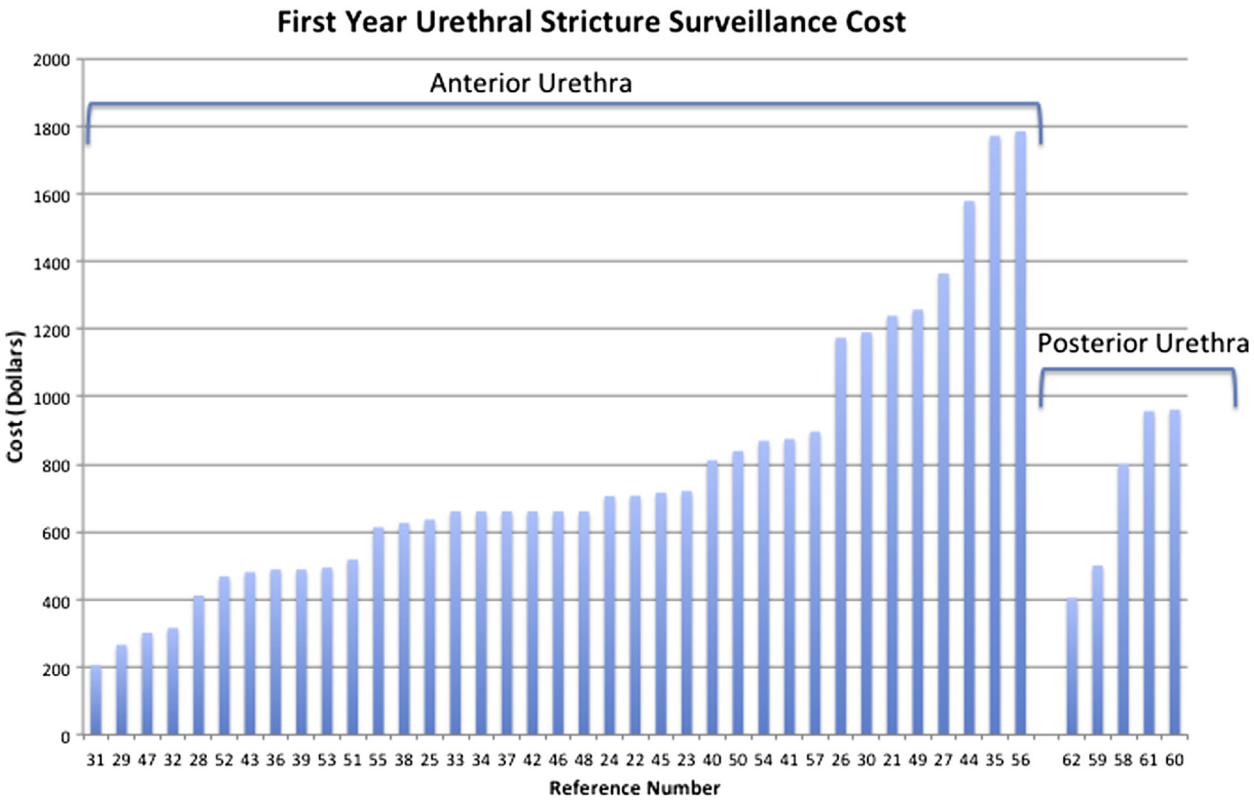

Figure 2. First-year cost of urethral stricture, anterior vs posterior stricture surveillance. The x-axis refers to study number (reference number) and the y-axis refers to cost (dollars). (Color version available online.)

Table 2. Costs by stricture type

Stricture Location	Cost Range ($)	Average Cost ± SD ($)	Median Cost ($)
Anterior	204.81-1784.01	777.30 ± 395.17	660.18
Posterior	404.03-961.02	724.19 ± 259.02	799.5
Panurethral	478.02-895.80	686.91 ± 295.42	686.91

SD, standard deviation.

than late treatment. Urethral strictures are different. There is no evidence that earlier treatment of asymptomatic stricture recurrence is beneficial.

CONCLUSION

There is significant practice variability for surveillance of urethral stricture recurrence. This correlates with notable differences in cost and is independent of the type of stricture and repair. The majority of surveillance costs are accrued during the first year after surgery. More invasive techniques have a higher sensitivity and specificity but are also associated with more adverse events. Ultimately, a risk-stratified model, where surveillance is tailored to the patient's risks factors, may be a more optimal approach to surveillance of urethral strictures. Although we have demonstrated great variability in both used technique and cost of surveillance after urethroplasty, the optimal method to follow-up patients has not been defined. We need a regimen that considers recurrence risk, patient experience, and cost. We may need different surveillance methods for patients enrolled in prospective urethroplasty outcome studies compared with standard urethroplasty patients as well. In addition to the costs of surveillance modalities, we must also consider the costs of delayed diagnosis or missed diagnosis, both in monetary term and patient quality of life terms.

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APPENDIX

Supplementary Data

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.urology.2014.12.047.

EDITORIAL COMMENT

The diagnosis, treatment, and follow-up of urethral stricture disease continues to be extremely variable among those who manage this disorder. The purpose of this excellent study[1] is to describe the wide disparities in surveillance regimens used after urethroplasty. Although the authors[1] do not advocate for one regimen over another, it becomes clear to the reader that if the outcomes are similar, we should favor a less-expensive regimen.

In this interesting article,[1] the authors have provided us with a well-designed meta-analysis of the published literature addressing the follow-up of men with urethral stricture disease after definitive repair. They use data of individual procedures and office visits extrapolated from charges from the standard 2013 nonfacility fee obtained from the Centers for Medicare and Medicaid Services. The most surprising finding of this article[1] is the significant discrepancy in the charges of follow-up between facilities. For instance, they identify a significant variability in charges during the first year after anterior urethral stricture repair ranging from $205 to $1784. This remarkable finding, based off of US data, may not correspond to any significant outcome differences, that is, those with more expensive testing do not fair any differently.

In our practice, we have strongly advocated for the use of noninvasive surveillance modalities such as the patient-reported outcome, American Urological Association symptom score, and a noninvasive uroflow and post void residual. We have found this to be extremely helpful in identifying recurrences while supporting patient comfort. We also agree with other published literature, which advocate for a risk-stratified model as the authors[1] point out in the discussion. Belsante and Morey describe a symptom-based risk-stratified algorithm with "low risk" patients being followed up with symptom scores and follow-up appointments only as needed, whereas "standard risk" patients are followed up with symptom scores, uroflow every 3 months for the first year, and a retrograde urethrogram at 3 and 12 months. With this approach, they demonstrate a significant savings.[2]

Data from the Centers for Medicare and Medicaid may be a valuable tool when comparing different treatment strategies. However, one must always use caution when making conclusions from studies centered on administrative or billing data. Additionally, this study would be even more significant if it stratified the findings based on stricture location and type. Unfortunately, by mixing data from these very different diseases (meatal, pendulous, bulbar, and posterior urethral stricture), it becomes difficult to make definitive decisions for follow-up. However, this study[1] still clearly supports the need for standardization of the follow-up of patients who have undergone primary repair of urethral stricture.

Most recently, some studies indicate that patient-reported outcomes as the sole method for surveillance after urethroplasty may identify recurrences early and inexpensively.[3] Imagine the impact of following up patients with only a simple questionnaire without the need for expensive and invasive studies such as cystoscopy and retrograde urethrogram. The American Urological Association and the Practice Guidelines Committee is currently evaluating this issue and implementation of standardized recommendations may significantly change practice patterns worldwide. It will be interesting to conduct this type of review and financial analysis after publication of these guidelines to establish whether practice patterns change.

Andrew C. Peterson, M.D., Duke University, Durham, NC

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