

# UCSF

## UC San Francisco Previously Published Works

### Title

Multi-Institutional Outcomes of Endoscopic Management of Stricture Recurrence after Bulbar Urethroplasty

### Permalink

<https://escholarship.org/uc/item/8f5737kb>

### Journal

Investigative Urology, 200(4)

### ISSN

0021-0005

### Authors

Sukumar, Shyam  
Elliott, Sean P  
Myers, Jeremy B  
et al.

### Publication Date

2018-10-01

### DOI

10.1016/j.juro.2018.04.081

Peer reviewed

# Author's Accepted Manuscript

Multi-institutional Outcomes of Endoscopic Management of Stricture Recurrence after Bulbar Urethroplasty

Shyam Sukumar , Sean P. Elliott , Jeremy B. Myers , Bryan B. Voelzke , Thomas G. Smith , III, Alexandra MC. Carolan , Michael Madaa , Alex J. Vanni , Benjamin N. Breyer , Bradley A. Erickson



PII: S0022-5347(18)43084-4  
DOI: [10.1016/j.juro.2018.04.081](https://doi.org/10.1016/j.juro.2018.04.081)  
Reference: JURO 15587

To appear in: *The Journal of Urology*

Please cite this article as: Sukumar S, Elliott SP, Myers JB, Voelzke BB, Smith TG III, Carolan AM, Madaa M, Vanni AJ, Breyer BN, Erickson BA, Multi-institutional Outcomes of Endoscopic Management of Stricture Recurrence after Bulbar Urethroplasty, *The Journal of Urology*® (2018), doi: 10.1016/j.juro.2018.04.081.

**DISCLAIMER:** This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our subscribers we are providing this early version of the article. The paper will be copy edited and typeset, and proof will be reviewed before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to The Journal pertain.

## Embargo Policy

**All article content is under embargo until uncorrected proof of the article becomes available online.**

We will provide journalists and editors with full-text copies of the articles in question prior to the embargo date so that stories can be adequately researched and written. The standard embargo time is 12:01 AM ET on that date. Questions regarding embargo should be directed to [jumedia@elsevier.com](mailto:jumedia@elsevier.com).

## Multi-institutional Outcomes of Endoscopic Management of Stricture Recurrence after Bulbar Urethroplasty

Shyam Sukumar, Sean P Elliott, Jeremy B Myers, Bryan B Voelzke, Thomas G Smith III, Alexandra MC Carolan, Michael Madaa, Alex J. Vanni, Benjamin N Breyer, Bradley A Erickson

Shyam Sukumar  
Department of Urology  
University of Minnesota  
Email: [ssukumar.md@gmail.com](mailto:ssukumar.md@gmail.com)

Sean P Elliott  
Department of Urology  
University of Minnesota  
Email: [selliott@umn.edu](mailto:selliott@umn.edu)

Jeremy B Myers  
Department of Urology  
University of Utah  
Email: [jeremy.myers@hsc.utah.edu](mailto:jeremy.myers@hsc.utah.edu)

Bryan B Voelzke  
Department of Urology  
University of Washington Medical Center  
Email: [voelzke@uw.edu](mailto:voelzke@uw.edu)

Thomas G Smith III  
Department of Urology  
Baylor College of Medicine  
Email: [tgsmith@bcm.edu](mailto:tgsmith@bcm.edu)

Alexandra MC Carolan  
Department of Urology  
University of Minnesota  
Email: [ciota001@umn.edu](mailto:ciota001@umn.edu)

Michael Madaa  
Department of Urology  
University of Iowa  
Email: [michael-madaa@uiowa.edu](mailto:michael-madaa@uiowa.edu)

Alex J Vanni  
Department of Urology  
Lahey Hospital and Medical Center

Email: [Alex.J.Vanni@lahey.org](mailto:Alex.J.Vanni@lahey.org)

Benjamin N Breyer  
Department of Urology  
University of California San Francisco  
Email: [Benjamin.Breyer@ucsf.edu](mailto:Benjamin.Breyer@ucsf.edu)

Bradley A Erickson  
Department of Urology  
University of Iowa  
Email: [brad-erickson@uiowa.edu](mailto:brad-erickson@uiowa.edu)

Running Head: Endoscopic management of post-urethroplasty strictures

Key Words: Urethral strictures, Urethroplasty, urethral dilation

## ABSTRACT

### Purpose

Approximately 10-20% of patients will have a recurrence after urethroplasty. Initial management of these recurrences is often with urethral dilation (UD) or direct vision internal urethrotomy (DVIU). In the current study, we describe outcomes of endoscopic management of stricture recurrence after bulbar urethroplasty.

### Materials and Methods

We retrospectively reviewed bulbar urethroplasty data from 5 surgeons from the Trauma and Urologic Reconstruction Network of Surgeons. Men who underwent UD or DVIU for urethroplasty recurrence were identified. Recurrence was defined as inability to pass a 17Fr cystoscope through the area of reconstruction. The primary outcome was the success rate of recurrence management. Comparisons were made between UD and DVIU and then between endoscopic management of recurrences after excision and primary anastomosis urethroplasty (EPA) versus substitutional repairs using time-to-event statistics.

### Results

There were 53 men with recurrence that were initially managed endoscopically. Median time to urethral stricture recurrence after urethroplasty was noted to be 5 months. At a median follow-up of 5 months, overall success was 42%. Success after UD (n=1/10, 10%) was significantly lower than after DVIU (n=21/43, 49%;  $p < 0.001$ ) with a hazard ratio of failure of 3.15 ( $p=0.03$ ). DVIU was more effective after substitutional failure than after EPA (53% vs.13%,  $P=0.005$ ).

### Conclusion

DVIU is more successful than UD in the management of stricture recurrence after bulbar urethroplasty. DVIU is more successful for patients with a recurrence after a substitution urethroplasty compared to after EPA, perhaps indicating a different

mechanism of recurrence for EPA (ischemic) versus substitution urethroplasty (non-ischemic).

**Abstract word count:** 250

**Source of Funding:** None

**Conflict of Interest/Disclosure statement:**

No financial disclosures

This abstract was presented as a podium presentation at AUA 2017 and was also a winner of the 2017 Minnesota Urological Society essay contest

## INTRODUCTION

Male urethral stricture disease has an incidence rate of up to 0.6%, with estimated direct costs for care of over \$200 million<sup>1</sup>. While urethroplasty is widely regarded as the gold standard in the management of patients with male urethral stricture disease, overall stricture recurrence rates after urethroplasty appear to be between 8.3-18.7% depending on the type and location of repair<sup>2</sup>. While endoscopic options, including urethral dilation (UD) and/or direct vision internal urethrotomy (DVIU), remain the most common initial management of these recurrences, the optimal management strategy for these patients remains unknown. Revision urethroplasty has a high success rate in this setting<sup>3-5</sup> but is significantly more invasive than endoscopic options.

In the current study, we describe outcomes of endoscopic management of stricture recurrence after bulbar urethroplasty. Our objective was to identify the best initial strategy for endoscopic management of patients who have a recurrence after urethroplasty.

## MATERIALS AND METHODS

### Study Population

Between 2007-2014 patients from seven institutions affiliated with the Trauma and Urologic Reconstruction Network of Surgeons (TURNS) were entered into an Institutional Review Board-approved database evaluating urethroplasty outcomes. The details of this prospective database have been published previously<sup>6</sup>. Included in the present study were patients that had undergone bulbar urethroplasty by one of the 5 surgeons that contributed data to the combined, web-based database, that had stricture recurrence, and for whom stricture recurrence outcomes and recurrence management data were available. The specific length of stricture recurrence was not recorded, though all substitution recurrences in this cohort were noted to occur at either the distal and/or proximal anastomosis and all recurrences after excision and primary anastomosis urethroplasty (EPA) were at the site of the original anastomosis. All EPAs were traditional transecting EPAs and nearly all substitution urethroplasties were performed with buccal graft applied either dorsally or ventrally.

### Definition of Urethroplasty Recurrence

We utilized the anatomic definition of stricture recurrence, in which a standard 17Fr flexible cystoscope is unable to navigate past the area of reconstruction without force<sup>7</sup>. Standard follow-up included 3- and 12-month cystoscopy, then yearly thereafter on an as needed basis<sup>6</sup>.

Men found to have anatomic stricture recurrence are generally offered endoscopic treatment prior to revision urethroplasty. However, men with asymptomatic recurrences will sometimes elect a watchful waiting strategy prior to any intervention assuming no active bladder and/or renal sequelae result. The



percentage of men that choose watchful waiting was determined for this study, but specific follow-up details on these men were not analyzed.

The choice of Urethral dilation or DVIU for the management of stricture recurrence was left to the discretion of the surgeon and recurrent stricture length and caliber were not available in our database. All UD's were performed using a 24 F balloon dilator manufactured by either Cook Medical (Bloomington, IN) or Boston Scientific (Marlborough, MA), both of which are non-conforming and are designed to handle pressures of up to 20 atm. All DVIU's were performed using a cold-knife. Incisions were generally made into the spongy tissue at 4 and 8 o'clock, but because recurrence characteristics are heterogeneous, other incisions were also made to accommodate stricture specific characteristics at the surgeon's discretion. All endoscopic procedures are followed by a short period of catheterization that ranges from 3 to 7 days.

Routine follow up after endoscopic repair included cystoscopy at 3 months, then every 6 months until stricture stabilization or need for repeat urethroplasty was determined. Notably, this differs from our cystoscopic followup after primary urethroplasty given the higher suspected chance of recurrence.

### Statistical Analysis

Our primary outcome was success after endoscopic treatment of stricture recurrence, which was defined as the ability to traverse the endoscopically managed stricture recurrence with a cystoscope without force. Sub-analyses included 1) a comparison of outcomes between DVIU and UD and 2) a comparison of DVIU outcomes for EPA and substitution recurrences. Time-to-event analysis was performed using Kaplan-Meier curves<sup>8</sup> and Cox regression models<sup>9</sup>. The threshold for statistical significance was considered to be at  $P < 0.05$ . All statistical analyses were performed using SPSS 20 (IBM Corp., Armonk, NY).

## RESULTS

### Demographics:

A total of 130 men experienced a recurrence after urethroplasty; 53 men (41%) elected to undergo initial endoscopic management of their recurrence and are the focus of this study. Of these patients, 23% were after EPA and 77% after substitution urethroplasty. Notably, only 4 patients that elected endoscopic management of their recurrence (7.5%) were completely asymptomatic at the time of routine cystoscopy. Median time to urethral stricture recurrence after urethroplasty was noted to be 5 months (interquartile range, IQR: 4-12 months).

Initial endoscopic management was DVIU in 81% (n=43) and urethral dilation in 19% (n = 10). All endoscopic procedures were conducted with a curative intent and none were augmented with an injection of steroid or other injectable meant to modify recurrence.

### *Direct Visual Internal Urethrotomy versus Urethral Dilation*

At a median follow-up of 5 months (IQR: 2.1-23 months) 41.5% of patients in the overall cohort were free from recurrence after endoscopic management. Success of DVIU (48.8%) was statistically higher than UD (10%;  $p < 0.0001$ ).

Time-to-event analysis revealed significant differences in the rate of recurrence between UD and DVIU (Log Rank  $P < 0.001$ ; Figure 1). Cox modeling revealed a 3-fold higher risk of failure for UD vs. DVIU (HR: 3.15, 95% confidence interval: 1.07-9.29;  $P = 0.038$ ) and a 2-fold higher risk (non-significant) for patients undergoing EPA vs. Substitution urethroplasty (HR: 2.41, 95% confidence interval: 0.99-5.85;  $P = 0.053$ ).

### *DVIU success for EPA versus Substitution Failures*

The success rate of DVIU for substitution repairs (53%) was significantly higher than for EPA failures (13%). On time-to-event analysis, DVIU was more successful after substitution urethroplasty than after EPA (Log Rank  $P=0.005$ )

ACCEPTED MANUSCRIPT

## DISCUSSION

Primary endoscopic management and urethroplasty are the major treatment options for patients with anterior urethral stricture disease, with the latter considered the current gold standard for patients with bulbar urethral strictures<sup>10-12</sup>. There is a high level of evidence that the two modalities of primary endoscopic management-UD and DVIU-have equal efficacy<sup>13, 14</sup> and this equivalency has been reiterated in the American Urological Association guideline on the management of male urethral strictures<sup>15</sup>. However recurrent stricture disease after primary urethroplasty is considered to be mechanistically different in its origin and it is unclear if the aforementioned equivalency extends to such patients. Specifically, recurrent urethral strictures after urethroplasty tend to be more focal (at the site of previous anastomoses), have less associated spongiofibrosis and better overall vascularity, as compared to primary urethral strictures<sup>16</sup>.

The current study evaluated the outcomes of endoscopic management of patients who have a recurrence after initial bulbar urethroplasty. We found that, at a mean follow up of 16 months, patients undergoing a DVIU for recurrent stricture disease after urethroplasty had statistically significantly higher rate of success (48%) compared to patients undergoing a urethral dilation (10%). Amongst a subset of the patients managed with DVIU after urethroplasty failure, DVIU after substitution urethroplasty was more successful than after EPA.

While this study is not specifically designed to elucidate the reasons for differences in success rates of the endoscopic failure managements, we believe a plausible explanation may exist that could affect clinical practice. EPA involves excision of the diseased segment of urethra and re-anastomosis of “healthy” proximal and distal segments. This anastomosis should be under no tension and in a spatulated manner, allowing for moderate post-procedural lumen contraction without affecting final lumen size. Therefore, assuming the procedure was

technically appropriate and that all diseased urethral tissue was appropriately excised, failure of the repair is more likely to be related to post-operative local ischemia and, thus will not respond well to endoscopic repair.

A substitution repair, on the other hand, is quite different in that transection of the urethra does not typically occur, which theoretically will better preserve local blood supply and make local ischemia a less likely cause of failure. Rather, technical concerns at the anastomotic sites and/or under-recognition of the stricture extent may be more plausible causes. Thus, an intact spongiosum at the site of failure after substitution urethroplasty may portend better outcomes with endoscopic management compared to the failures after EPA.

Of note, our success rate (42%) of endoscopic management after urethroplasty failure is lower than earlier reports (50-70%)<sup>17-19</sup>; however, these reports have been either single institution series or have had a small sample size of recurrences or did not have a standardized definition of treatment failure. To our knowledge, the current report is the largest multi-institutional analysis of outcomes of initial endoscopic management in patients who have a recurrence after initial urethroplasty.

This study has limitations that deserve special mention. First, this is a retrospective study of prospectively entered data and, as such, is subject to the biases pertinent to such studies<sup>20</sup>. Second, while the overall number of patients was small (53) and the median follow-up was only 5 months, this is (to our knowledge) the largest multi-institutional study addressing the issue of endoscopic management of urethroplasty recurrences. Third, the choice of whether to perform DVIU vs. UD was left up to the discretion of the surgeon. As described in the above paragraph, these have procedures previously been shown to have similar efficacy. However, given the findings in the current study, future studies of endoscopic management after urethroplasty should account for different success rates of DVIU vs. dilation. Fourth, not all patients with anatomic

recurrences underwent treatment, as many were asymptomatic (i.e., not a functional recurrence). Thus, there is some selection bias and it is unclear how this affects outcomes. Fifth, we do not have information on the recurrent stricture characteristics, including stricture length or caliber, which may have offered even more insight into which types of recurrences were likely to be amenable to endoscopic repair. Finally, while we postulate a different mechanism of failure after DVIU vs. dilation, we did not have histological data (tissue diagnosis) that might help elucidate tissue-level metrics.

## CONCLUSIONS

DVIU is superior to urethral dilation for the management of stricture recurrence after bulbar urethroplasty. DVIU is more successful for patients with a recurrence after a substitution urethroplasty compared to after EPA, perhaps indicating a different mechanism of recurrence for EPA (ischemic) versus substitution urethroplasty (non-ischemic).

## REFERENCES

1. Santucci, R. A., Joyce, G. F., Wise, M.: Male urethral stricture disease. *J Urol*, 177: 1667, 2007
2. Meeks, J. J., Erickson, B. A., Granieri, M. A. et al.: Stricture recurrence after urethroplasty: a systematic review. *J Urol*, 182: 1266, 2009
3. Javali, T. D., Katti, A., Nagaraj, H. K.: Management of recurrent anterior urethral strictures following buccal mucosal graft-urethroplasty: A single center experience. *Urol Ann*, 8: 31, 2016
4. Levine, M. A., Kinnaird, A. S., Rourke, K. F.: Revision urethroplasty success is comparable to primary urethroplasty: a comparative analysis. *Urology*, 84: 928, 2014
5. Blaschko, S. D., McAninch, J. W., Myers, J. B. et al.: Repeat urethroplasty after failed urethral reconstruction: outcome analysis of 130 patients. *J Urol*, 188: 2260, 2012
6. Erickson, B. A., Elliott, S. P., Voelzke, B. B. et al.: Multi-institutional 1-year bulbar urethroplasty outcomes using a standardized prospective cystoscopic follow-up protocol. *Urology*, 84: 213, 2014
7. Erickson, B. A., Ghareeb, G. M.: Definition of Successful Treatment and Optimal Follow-up after Urethral Reconstruction for Urethral Stricture Disease. *Urol Clin North Am*, 44: 1, 2017
8. Kaplan, E. L., Meier, P.: Nonparametric estimation from incomplete observations. *J. Amer. Statist. Assn.*, 53 (282): 457–481, 1958
9. Cox, D. R.: Regression Models and Life-Tables. *Journal of the Royal Statistical Society, Series B.* 34 (2): 187–220, 1972
10. Buckley, J. C., Heyns, C., Gilling, P. et al.: SIU/ICUD Consultation on Urethral Strictures: Dilation, internal urethrotomy, and stenting of male anterior urethral strictures. *Urology*, 83: S18, 2014
11. Morey, A. F., Watkin, N., Shenfeld, O. et al.: SIU/ICUD Consultation on Urethral Strictures: Anterior urethra--primary anastomosis. *Urology*, 83: S23, 2014
12. 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*, 83: S31, 2014
13. Steenkamp, J. W., Heyns, C. F., de Kock, M. L.: Internal urethrotomy versus dilation as treatment for male urethral strictures: a prospective, randomized comparison. *J Urol*, 157: 98, 1997
14. Wong, S. S., Aboumarzouk, O. M., Narahari, R. et al.: Simple urethral dilatation, endoscopic urethrotomy, and urethroplasty for urethral stricture disease in adult men. *Cochrane Database Syst Rev*, 12: CD006934, 2012
15. Wessells, H., Angermeier, K. W., Elliott, S. et al.: Male Urethral Stricture: American Urological Association Guideline. *J Urol*, 197: 182, 2017

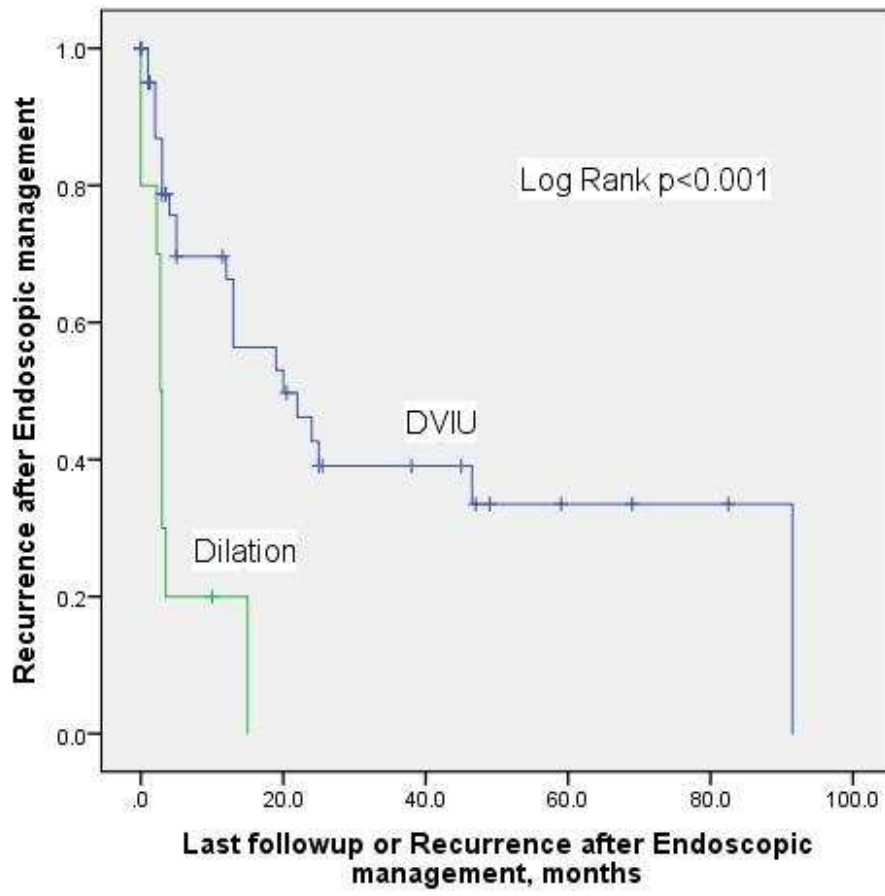


16. Voelzke, B. B., Wessells, H.: Role of Direct Vision Internal Urethrotomy in the Management of Urethral Stricture. AUA Update Series Volume 29 Lesson 20, 2010
17. Elliott, S. P., Metro, M. J., McAninch, J. W.: Long-term followup of the ventrally placed buccal mucosa onlay graft in bulbar urethral reconstruction. J Urol, 169: 1754, 2003
18. Brown, E. T., Mock, S., Dmochowski, R. et al.: Direct visual internal urethrotomy for isolated, post-urethroplasty strictures: a retrospective analysis. Ther Adv Urol, 9: 39, 2017
19. Rosenbaum, C. M., Schmid, M., Ludwig, T. A. et al.: Internal urethrotomy in patients with recurrent urethral stricture after buccal mucosa graft urethroplasty. World J Urol, 33: 1337, 2015
20. Ward, R. A., Brier, M. E.: Retrospective analyses of large medical databases: what do they tell us? J Am Soc Nephrol, 10: 429, 1999

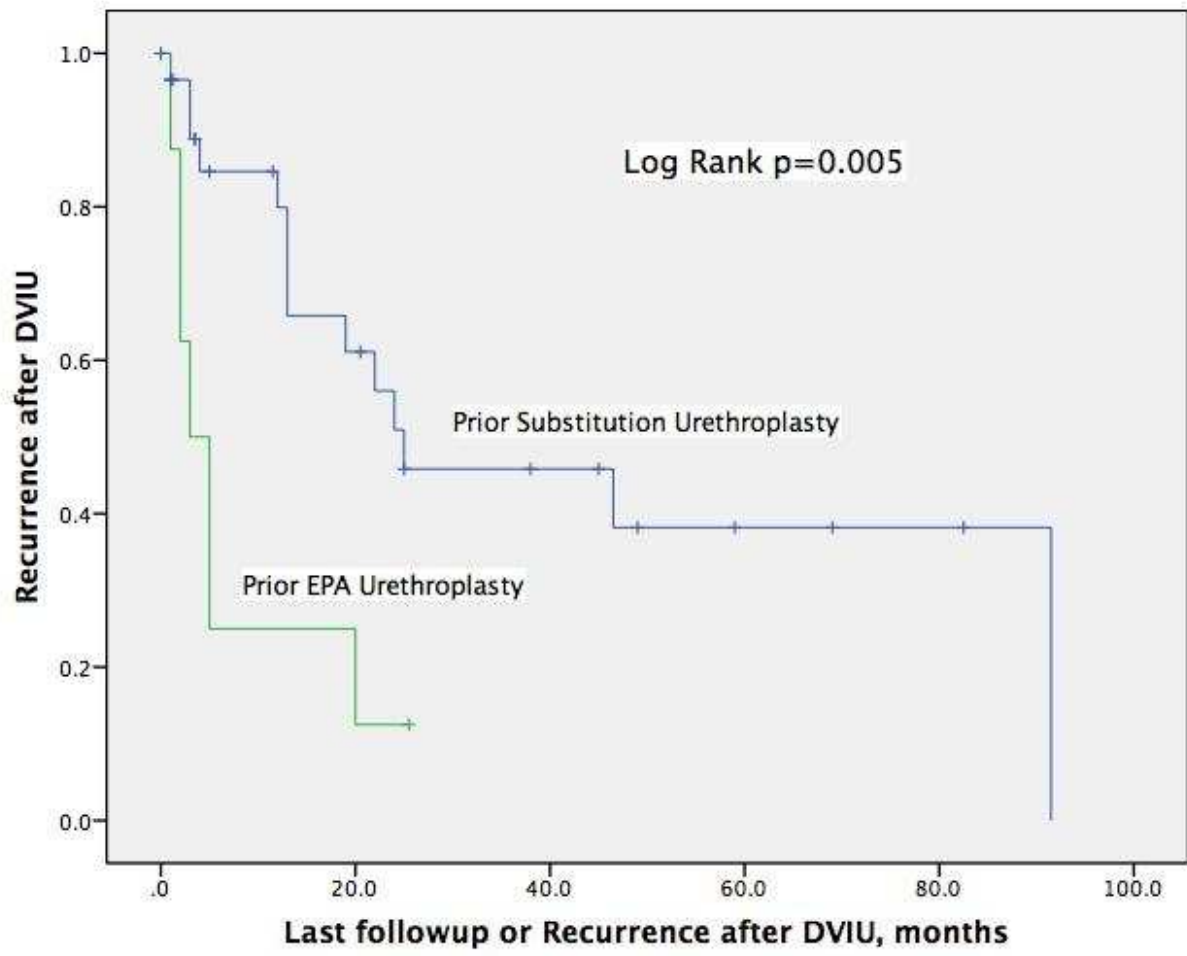
#### LEGENDS:

**Figure 1.** Kaplan-Meier analysis of Failures after Endoscopic Management of Urethroplasty Recurrences: Stratified by Type of Endoscopic Management

**Figure 2.** Kaplan-Meier Analysis of Failures after Direct Vision Internal Urethrotomy Performed as the Initial Management for Urethroplasty Recurrences: Stratified by Type of Primary Urethroplasty



ACCEPTED



ACCEPTED

**Key of Definitions for Abbreviations**

DVIU: direct vision internal urethrotomy

UD: urethral dilation

EPA: excision and primary anastomosis urethroplasty

TURNS: Trauma and Urologic Reconstruction Network of Surgeons