Prospective assessment of the incidence and associations of postvoid dribbling after urethroplasty

Impact of surgical technique

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ABSTRACT

INTRODUCTION: The incidence and associations of postvoid dribbling (PVD) after urethroplasty remains unclear. The purpose of this study was to examine the impact of urethroplasty on PVD and factors associated with de novo PVD.

METHODS: From 2011–2018, patients were offered enrollment in a prospective study assessing PVD after urethroplasty. PVD was assessed preoperatively and six months post-surgery with the question, "After urinating, do you have post-urination dribbling or leakage of urine?" Choices included, "Never" (1), "Occasionally" (2), "Sometimes" (3), "Most of the time" (4), or "All of the time" (5). A response of 3–5 was considered clinically significant. Wilcoxon signed-rank test was used to compare pre- and postoperative PVD, while logistic regression was used to determine the association between new-onset PVD and clinical variables.

RESULTS: A total of 384 patients completed the study, with 46.9% (180) reporting PVD preoperatively compared to 39.8% (153) postoperatively (p=0.01); 18.0% (67) of patients experienced de novo PVD, 57.0% (219) no change, and 25.0% (96) reported improvement. On multivariable logistic regression, patients undergoing anastomotic urethroplasty were less likely to report de novo PVD (odds ratio [OR] 0.33, 95% confidence interval [CI] 0.13–0.83, p=0.02). No other factor was associated with de novo PVD, including age (p=0.59), stricture length (p=0.71), location (p=0.50), etiology (p=0.59), failed endoscopic treatment (p=0.18), previous urethroplasty (p=0.55), or recurrence (p=0.78). De novo PVD was not associated with patient dissatisfaction (10.1% vs. 7.6%, p=0.49).

CONCLUSIONS: PVD is common in patients with urethral stricture. While there is an overall improvement after urethroplasty, 18.0% of patients will experience de novo PVD, with a reduced incidence in those undergoing anastomotic urethroplasty.

INTRODUCTION

Postvoid dribbling (PVD) of urine is defined by the International Continence Society (ICS) as the "involuntary loss of urine immediately after he or she has finished passing urine, usually after leaving the toilet in men, or after rising from the toilet in women."[1] This condition is likely more common than generally thought, and depending on the definition, its prevalence in the general population can vary from 5.5–58.1%.[2] Traditionally, this phenomenon has been somewhat neglected as a minor, age-related issue but it is now clear that postmicturition symptoms can have a negative impact on health-related quality of life, especially in men in their 30s.[3,4]

Based on limited study, PVD may be common in patients with urethral stricture, with a reported incidence of up to 73% in patients presenting for urethroplasty;[5] however, if only de novo PVD is examined, which would be the effect attributed to any intervention, the incidence postoperatively is potentially much lower.[6] Preoperative PVD is thought to be generated by the stricture itself, which causes pooling of urine in the hydrodistended urethral proximal to the stenotic segment.[7] Alternately, de novo PVD seems to be the phenomenon of interest in order to assess the effect of urethroplasty on urethral function. Mobilization of the bulbospongiosus muscle with subsequent dysfunction or decreased pliability of an interposed graft are pos-

KEY MESSAGES

- Postvoid dribbling (PVD) is common in patients with urethral stricture and with an incidence of 46.9% in patients presenting for urethroplasty.
- There is an overall improvement after urethroplasty but 18.0% of patients will experience de novo PVD.
- De novo PVD is not associated with patient dissatisfaction.
- Patients undergoing anastomotic urethroplasty are less likely to experience de novo PVD.
- Stricture length, location, etiology, failed endoscopic treatment, previous urethroplasty patient age, or recurrence do not impact the occurrence of PVD.

sible reasons explaining the loss of urethral coaptation after voiding.[8] On balance, the exact incidence, cause, and impact of PVD after urethroplasty remain unclear.

The objectives of this study were to examine the incidence of PVD in patients presenting for urethroplasty, determine the impact of urethroplasty on PVD, and evaluate clinical factors associated with de novo PVD. We hypothesize that PVD is common in patients with urethral stricture, urethroplasty will result in improvement, and a lack of tissue transfer during urethroplasty will reduce the occurrence of de novo PVD.

METHODS

A prospective, single-center cohort study was conducted on patients undergoing urethroplasty by a single reconstructive urologist. From 2011–2018, patients were offered enrollment in a study assessing patient-reported PVD before and after surgery. Patients completed questionnaires preoperatively and at approximately six months postoperatively. Only consenting patients were included if they had completed both the pre- and a six-month postoperative questionnaire. Specifically, PVD was assessed using a five-point scale in response to the question, "After urinating, do you have post-urination dribbling or leakage of urine?" Possible answers were "Never" (1), "Occasionally" (2), "Sometimes" (3), "Most of the time" (4), or "All of the time" (5). Clinically significant PVD was considered a response of 3–5. A change of at least one point on this scale was considered improvement or worsening of their PVD. Patient characteristics, including age, stricture length, location, etiology, prior treatment history, and stricture recurrence, were recorded from regional electronic health records. Urethroplasty technique was chosen at the discretion of the surgeon according to the features of the stricture and preoperative patient factors. Concurrently, patient satisfaction after surgery was assessed using a five-point

Table 1. Clinical demographics of the study cohort

Variable	% (n)
Number of patients	384
Patient age (years)	Mean 49.5±16.3 Median 50 (18–94)
Stricture location	
Penile	19.5% (75/384)
Bulbar	59.4% (228)
Posterior	13.8% (53)
Panurethral	7.3% (28)
Stricture length (cm)	Mean 4.5±3.6 Median 4 (1–20)
Stricture etiology	
Idiopathic	40.1% (154/384)
Trauma	12.2% (47)
Lichen sclerosus	12.5% (48)
Radiation	9.1% (35)
Hypospadias	10.2% (39)
Iatrogenic	14.1% (54)
Infectious	1.8% (7)
Failed prior endoscopic treatment	84.9% (326)
Number of prior endoscopic treatments	Mean 3.0±3.2 Median 2 (0–20)
Prior urethroplasty	21.1% (81)
Type of urethroplasty	
Onlay with buccal mucosa	51.8% (199)
Onlay with penile fasciocutaneous flap	1.8% (7)
Anastomotic	30.7% (118)
Staged	12.0% (46)
Combined tissue	3.6% (14)
Stricture-free at 6 months	94.5% (363/378)

Table 2. Patient-reported pre- and postoperative postvoid dribbling status

Outcome	% (n)	p
Clinically significant		
Preoperative postvoid dribbling	46.9% (180/384)	
Postoperative postvoid dribbling	39.8% (153/384)	0.01* (Wilcoxon)
Any severity		
De novo postvoid dribbling	18.0% (69/384)	
Improved postvoid dribbling	25.0% (96/384)	
No change	57.0% (219/384)	

*Clinically significant.

Likert scale ranging from very dissatisfied to very satisfied. The ability to introduce a 16 Fr flexible cystoscope at six months postoperatively defined anatomic surgical success. Ethical approval was granted by the regional health ethics review board (Pro00003680).

Collected data was tabulated using Microsoft Excel 15.33 (Microsoft Office 2017) to facilitate interpretation. Results were imported to IBM SPSS Statistics 25 (IBM Corp, Armonk, NY, U.S.) for statistical analysis. Descriptive statistics were used to summarize findings. Wilcoxon signed-rank test was used to compare pre- and postoperative incidence of PVD. Multivariable binary logistic regression was used to determine independent association between clinical variables and de novo PVD. The predetermined alpha value for significance was set at 0.05.

RESULTS

During the study period, 828 patients underwent urethroplasty and were offered participation in the study. A total of 384 patients completed both pre- and postoperative questionnaires, constituting the study group. Table 1 summarizes the clinical features and the characteristics of the study cohort. When examining patient-reported pre- and postoperative PVD status (Table 2), 46.9% (180) of patients reported clinically significant preoperatively PVD compared to 39.8% (153) postoperatively (p=0.01). After urethroplasty, 25% (96) of patients reported improvement in PVD, 57% (219) remained unchanged, but 18% (69) of patients experienced de novo PVD. No patient suffered worsening of their PVD (Figure 1).

On multivariable binary logistic regression (Table 3), urethroplasty technique was associated with de novo PVD (p=0.05). In particular, patients undergoing anastomotic urethroplasty were less likely to report de novo PVD (odds ratio [OR] 0.33, 95% confidence interval [CI] 0.13–0.83, p=0.02) taking onlay grafting as a reference. No other factor was associated with de novo PVD, including age (p=0.59), stricture length (p=0.71), location (p=0.50), etiology (p=0.59), failed endoscopic treatment (p=0.18), previous urethroplasty (p=0.55), or stricture recurrence (p=0.78). De novo PVD was not associated with patient dissatisfaction (10.1% vs. 7.6%, p=0.49).

DISCUSSION

Incidence of PVD in patients with urethral stricture

The present study assesses pre- and post-urethroplasty frequency of PVD in a single-center, prospective study.

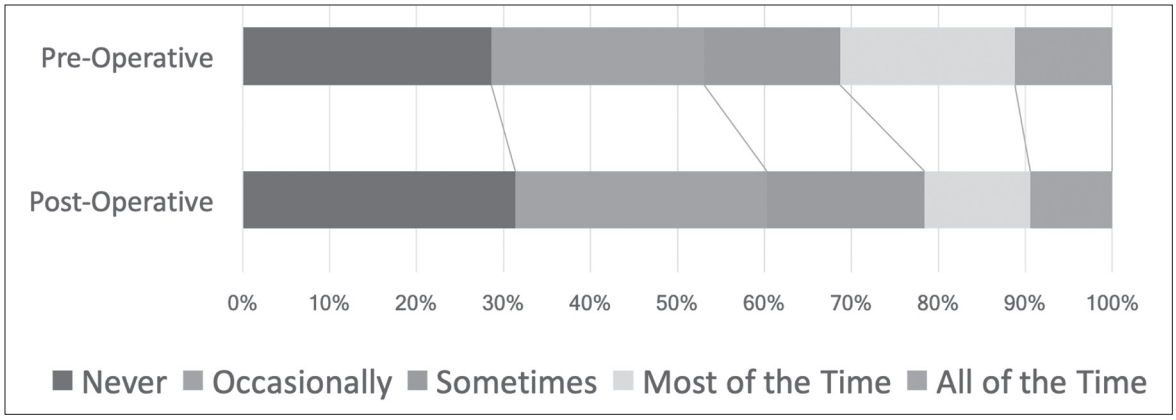

Figure 1. Stacked bar chart demonstrating preoperative and postoperative postvoid dribbling status for the study cohort. Preoperatively, patients responded 11.2% "All of the time," 20.1% "Most of the time," 15.6% "Sometimes," 24.5% "Occasionally," and 28.6% "Never." Postoperatively, responses were significantly improved (p=0.01), with a shift in responses to 9.4% "All of the time," 12.2% "Most of the time," 18.1% "Sometimes," 28.9% "Occasionally," and 31.3% "Never."

Table 3. Multivariable binary logistic regression analysis of outcomes independently associated with de novo post-void dribbling after urethroplasty

Factors	n (%) if applicable	p	OR (95% CI)
Age (years)	N/A	0.59	0.99 (0.97–1.02)
Length (cm)	N/A	0.71	0.97 (0.81–1.15)
Location		0.50	
Penile	8/75 (10.7)	Referent	
Bulbar	47/228 (20.6)	0.18	2.78 (0.61–12.59)
Posterior	12/53 (22.6)	0.13	4.1 (0.66–25.22)
Panurethral	2/28 (7.1)	0.73	1.58 (0.12–20.62)
Etiology		0.59	
Idiopathic	28/154 (18.2)	Referent	
Trauma	12/47 (25.5)	0.13	1.89 (0.82–4.34)
Lichen sclerosus	3/48 (6.3)	0.47	0.51 (0.08–3.18)
Radiation	10/35 (28.6)	0.18	2.23 (0.70–7.11)
Hypospadias	6/39 (15.4)	0.81	1.26 (0.20–8.18)
Iatrogenic	10/54 (18.5)	0.65	1.24 (0.50–3.06)
Infectious	0/7 (0)	0.99	1.00 (1.00–1.00)
Number of endoscopic treatments	N/A	0.18	1.06 (0.97–1.15)
Prior urethroplasty	12/81 (14.8) vs. 57/303 (18.8)	0.55	0.77 (0.32–1.84)
Type of urethroplasty		0.05*	
Onlay	46/220 (20.9)	Referent	
Anastomotic	17/118 (14.4)	0.02*	0.33 (0.13–0.83)
Staged	6/46 (13.0)	0.64	1.58 (0.23–10.87)
Stricture recurrence	6/32 (18.8) vs. 63/352 (17.9)	0.78	1.16 (0.42–3.22)

*Clinically significant. CI: confidence interval; OR: odds ratio.

Preoperatively, almost half of patients undergoing urethroplasty (47%) experienced PVD. It's important to note that PVD must be distinguished from terminal dribble, which is the "complaint that during the final part of voiding, there is noticeable slowing of the flow to drops;" the latter is considered a voiding symptom, while the former is a post-micturition complaint.[1] We used the question, "After urinating, do you have post-urination dribbling or leakage of urine?" which doubly specifies that the addressed phenomenon is after the termination of voiding and is unlikely to be confused with terminal dribble.

Prevalence of PVD in the general population varies greatly, with estimates ranging from 5.5–58.1%, which is potentially related to a lack of standardized definition.[4,9] Several different questionnaires have been developed but there is no globally accepted consensus on which to use. Using a similar definition, the Trauma and Urologic Reconstructive Network of Surgeons (TURNS) evaluated the prevalence of PVD in patients undergoing urethroplasty using multi-institutional data.[5] They asked patients, "How often have you had a slight wetting of your pants a few minutes after you had finished urinating and had dressed yourself?" with answers ranging from "Never" (0) to "Most of the time" (3); any answer except "Never" was considered clinically significant PVD. With this rather broad definition, they found that 73% of patients complained of PVD preoperatively. Furthermore, stricture characteristics were unable to reliably predict the occurrence of PVD in this population. On balance, PVD is a common and potentially very important patient-centered symptom of urethral stricture, with a likely incidence of 50–70% in these patients.

Impact of urethroplasty

In this prospective cohort undergoing urethroplasty, patient-reported PVD significantly improved postoperatively when compared to the preoperative state (46.9% to 39.8%). While most patients were unchanged, 25% reported improvement and 18% reported de novo PVD. Typically, in this population, the overall severity of PVD was reduced. For example, the incidence of patients complaining of PVD "most of the time" or "always" was reduced from 31.3% to 21.6%. This phenomenon was also seen in the aforementioned TURNS study, which found 45% of their patients improved after surgery.[5] These findings support the idea that one of the mechanisms explaining PVD is pooling of urine proximal to the stricture, which would resolve after patency is achieved with urethroplasty; however, the question of why some patients develop de novo PVD persists.

Factors associated with de novo PVD

The TURNS study hypothesized that the reason some patients develop de novo PVD is potentially related to urethroplasty technique;[6] however, they could not corroborate this idea, possibly due to the small proportion of patients reporting de novo PVD (6.3%). Of significance, our series demonstrated that de novo PVD is less likely to occur in patients undergoing anastomotic urethroplasty as opposed to patients undergoing urethroplasty with tissue transfer (14.4% vs. 20.9%). This reflects the possibility that grafting might alter urethral contractility, causing some urine to become sequestered within the urethral lumen postvoid.

Another proposed mechanism of de novo PVD is that of a vascular origin, which is in line with the reported correlation between PVD and erectile dysfunction.[10] Moreover, this hypothesis is further supported by the observation that daily administration of PDE-5 inhibitors seems to reduce PVD when compared to placebo.[11] In our center, there has been a tendency to avoid transection of the corpus spongiosum whenever feasible, with preservation of antegrade arterial circulation from the bulbourethral arteries. This approach might contribute to the reduced proportion of PVD seen in patients undergoing anastomotic reconstruction. No factors were associated with de novo PVD other than a lower incidence in those undergoing anastomotic urethroplasty. Stricture length, location etiology, failed endoscopic treatment, and previous urethroplasty were not associated with patient-reported de novo PVD. These findings are remarkably consistent with the prior TURNS study, which lends a great degree of certainty to these study findings.

Limitations

As mentioned, there is a lack of validated and standardized questionnaires addressing PVD in patients undergoing urethroplasty, which is an important limitation to our study. This may also render comparison between studies challenging. This being an observational study, we were dependent on patients' willingness to respond to the questionnaire, which may have introduced bias. Given that this is a single-institution, single-surgeon cohort, there is a potential selection bias with respect to patient selection and surgical technique; however, patient demographics, stricture characteristics, and surgical techniques are consistent with that of contemporary patient population from an industrialized nation. Lastly, we assessed patients postoperatively at the six-month mark and this may have overestimated the impact of surgery on de novo PVD. With further graft maturation, it is entirely plausible that there may have been time-dependent improvement in PVD as graft compliance improved.[12] Nonetheless, symptoms persisting for six months can potentially impact the patient experience postoperatively.

CONCLUSIONS

PVD is common in patients with urethral stricture. While there is an overall improvement in PVD after urethroplasty, 18.0% of patients will experience de novo PVD. Patients undergoing anastomotic urethroplasty are less likely to experience de novo PVD than those undergoing other urethroplasty techniques. The exact impact on patient dissatisfaction remains unclear.

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