Urinary and Sexual Outcomes Following Bulbar Urethroplasty—An Analysis of 2 Common Approaches

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OBJECTIVE To report success and patient reported urinary and sexual outcomes of patients who underwent anastomotic urethroplasty and dorsal buccal onlay urethroplasty.

MATERIALS AND METHODS Patients who underwent primary transecting anastomotic or dorsal buccal onlay urethroplasty for bulbar strictures at our institution between 1998 and 2015 were analyzed. Patients who had a prior urethroplasty, involvement of a different portion of the urethra, or a diagnosis of lichen sclerosis (LS) or hypospadias were excluded. Outcomes were assessed by cystoscopy at 4 months, validated questionnaires assessing urinary, erectile, and ejaculatory function at the time of their most recent assessment.

RESULTS A total of 40 and 139 patients were included in the dorsal buccal and anastomotic groups, respectively. Wide patency at 4-month cystoscopy was 97.5% and 100% (P= .06) and the long-term success was 95% and 99.3% (P= .06) with a mean follow-up of 51.4 and 63.3 months. Patient reported outcomes were similar with 2 exceptions: postvoid dribbling was reported more often in the onlay group (28.1% vs 8.3%, P< .0001), and tethering with erections in the anastomotic group (23.4% vs 3.1%, P= .008). Ninety-eight percent of patients in the anastomotic group and 91% in the dorsal buccal onlay group would choose their surgery again (P= .07).

CONCLUSION Both anastomotic urethroplasty and dorsal onlay graft are associated with high success with comparable satisfaction. Patient reported outcome measures were similar regardless of approach, despite inherent differences in stricture length. Our data indicates that anastomotic urethroplasty should not be avoided due to concerns of sexual side effects. UROLOGY 130: 162–166, 2019.

Excision and primary anastomosis (EPA) has historically been the treatment of choice for short bulbar urethral strictures due to its very high success rate, long-term durability, and decreased morbidity that may result from other tissue transfer techniques.[1] Over the last few years however, more authors are avoiding transection of the corpus spongiosum due to concerns over possible sexual side effects.[2,3]

Several techniques have been described to avoid transection of the spongiosum including a nontransecting anastomotic approach initially described by Jordan[4] and subsequently by Andrich and Mundy.[5] Others prefer to avoid the anastomotic approach altogether and advocate that substitution urethroplasty with buccal grafting should be the procedure of choice even in short strictures that are otherwise amenable to EPA.[6]

The concerns that have been raised about EPA with urethral transection in particular include possible penile length loss, tethering of the penis with erections, change in penile and glans sensation, decreased glans fullness, or development of a cold glans.[6,7] Our own review of the literature found that studies that offer data on success rates do not include patient reported outcomes to compare side effects.[3,8] In this study, we aim to report the early and late success rates and patient reported outcomes of sexual and urinary function of both bulbar transecting anastamotic and dorsal onlay buccal graft urethroplasty. We hypothesize that EPA has comparable patient reported outcome measures (PROM) to Dorsal Buccal Grafting (DBG).

MATERIALS AND METHODS

With IRB approval, we reviewed our prospectively maintained urethroplasty database to identify all patients who underwent DBG or EPA urethroplasty for a bulbar stricture between 1998 and 2015. PROMs were collected on all willing to comply either via email, phone call, or in person at follow-up appointment. To ensure the outcomes were measuring only the procedures we intended to analyze, all patients who had any other type of concurrent or prior open reconstruction were excluded. Exclusion criteria included any patient who had stricture disease extending to, or involving, any other portion of the urethra, any patient with a stricture long enough to require more than 1 buccal graft harvest, or any patient who had a diagnosis of hypospadias or lichen

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sclerosis. EPA was performed in a transecting fashion, and was typically reserved for shorter (<3 cm), more proximal bulbar strictures. DBG was typically reserved for less discrete longer strictures (>3-3.5 cm) and those involving the more distal bulbar urethra.

Our follow-up protocol has always included a voiding cystourethrogram 3 weeks after surgery, cystoscopy 4 months after surgery assess early success, and then subsequent annual symptom and postvoid residual assessment. Any patient who did not return for cystoscopic assessment to assess patency was excluded. Early success was defined as the easy passage of a 16 Fr flexible cystoscope through the entire anterior urethra at the time of 4-month cystoscopy. Long-term success was defined as either an absence of lower urinary tract symptoms based on validated questionnaires, or confirmation of continued patency on repeat cystoscopy if there was development of obstructive voiding symptoms, elevated residuals, or urinary tract infections.

Endpoints were success rates, both early and long-term, and PROMs. At the time of initial 4-month cystoscopy, patients completed validated questionnaires to assess voiding (American Urologic Association symptom score), erectile (Sexual Health Inventory for Men), and ejaculatory function (4-item Mens Sexual Health Questionnaire − Ejaculatory Dysfunction). Other urethroplasty-specific questions were asked in accordance with questionnaires previously published by Jackson et al and Barbagli et al.[7,9] Questionnaires were repeated at subsequent yearly follow-up, or via email or phone call if patient did not return for the yearly follow-up. Questionnaires are provided in Appendix 1. Follow-up length was defined as the number of months between surgery and most recent contact (either by in-clinic follow-up or questionnaire response) and not simply the amount of time that elapsed after surgery. Analysis was performed based on patient's most recent questionnaire data. To minimize bias, surgeons were excluded from obtaining PROM data. Statistical analysis was performed using JMP 12(c) software to compare success rates as well as each PROM. Student's *t* test and chi-squared analysis were performed where appropriate, with statistical significance set at $P < .05$.

RESULTS

Over the study period, a total of 359 patients underwent bulbar urethroplasty. Of these patients, 84% underwent follow-up 4-month cystoscopy. Inclusion criteria were met in 179 patients, with 40 patients included in the DBG group and 139 in the EPA group. In the DBG group, average age was 42.8 years and average stricture length was 3.98 cm. Mean follow-up was 51.4 months with both early and long-term success were 97.5% and 95%, respectively. In the EPA group, stricture length was 1.7 cm with mean age of 40.5 years and a mean follow-up of 63.3 months. The early and long-term success of the EPA group was 100% and 99.3%, respectively. Results of DBG and EPA group are shown in Table 1. The 2 groups were very similar at baseline except that strictures were approximately 2 cm longer in the DBG group (3.98 cm vs 1.7 cm, $P < .001$).

For the purposes of determining long-term success with PROM, 71.5% of patients in the cohort successfully were contacted and participated in postoperative validated urinary, sexual, and ejaculatory questionnaires as well as other questions measuring urethroplasty specific outcomes (Table 2). Of this group, 80% (n = 32) were those that underwent DBG and 69% (n = 96) were those who underwent EPA. The length of follow-up in patients participating in questionnaires was 75.1 months, with 30 patients providing data more than a decade from their operation.

There were only 2 significant differences: postvoid dribbling that occurred most or all of the time was reported significantly more often with DBG (28.1% vs 8.3%, $P < .0001$), while tethering with erections was reported more frequently with EPA (23.4% vs 3.1%, $P = .008$). Of the patients who developed tethering subsequent to EPA, the average stricture length was not significantly longer than the rest of the EPA cohort (1.9 cm vs 1.7 cm) and the average Sexual Health Inventory for Men (SHIM) score was still very acceptable at 18. Ejaculatory bother trended slightly higher in the DBG group, and 5 patients in the EPA group reported having a cold glans, although these differences did not reach statistical significance. The 2 groups were otherwise very similar with regards to all urinary and sexual outcomes, and satisfaction rates were very high for both groups.

COMMENT

The ideal treatment of short bulbar strictures has become controversial in recent years, although historically, EPA was widely considered the gold standard mostly due to excellent success rates and long-term durability associated with this technique. A meta-analysis performed by Morey et al as part of the International Consultation on Urologic Disease (ICUD) on urethral strictures revealed an overall success rate of 93.8%.[10] In one of the largest single-institution series ever published, an early success rate of 98.8% was achieved with 260 patients and a mean of 50.2 months follow-up.[1] Another well-known study reported a 95% success in 168 patients with a mean follow-up of 70 months, with a range of follow-up that extended up to 24 years, attesting to the long-term durability of EPA.[11] Our current findings of 99.3% success in 140 patients with 60 months follow-up appears to confirm the exceptionally high success rates that is often reported with this technique.

Urethroplasty with buccal grafting has also demonstrated excellent results, but some of the larger series have not reported comparably high success rates. A meta-analysis of substitution urethroplasties performed by Chapple et al as part of the ICUD on urethral strictures reported an

Table 1. Technical and long-term success rates of all patients

	DBG	EPA	*P* Value
N:	40	139	
Age (years)	42.8	40.5	.58
Stricture Length (cm)	3.98 cm	1.7 cm	<.001
Early Success	39/40 (97.5%)	139/139 (100%)	.06
Long-term Success	38/40 (95%)	138/139 (99.3%)	.06
Follow-up (months)	51.4	63.3	.16

Table 2. Mean patient reported outcome measures

	DBG (n = 32)	EPA (n = 96)	*P*
AUA symptom score	4.9	4.9	.94
SHIM score	18.4	17.1	.44
Overall SHIM > 15	69%	69%	.94
Potency*	75%	80%	.51
More difficulty achieving erections†	31%	27%	.2
Ejaculatory score	9.4	10.5	.25
Ejaculatory bother (1 = not at all, 5 = extremely)	1.59	1.07	.07
Postvoid dribbling (most or all of the time)	28.1%	8.3%	**<.001**
Penile tethering with erections‡	3.1%	23.4%	**.008**
Decreased glans filling§	9.4%	10.6%	1
Cold glans during erection	0%	5.2%	.19
Decreased penile sensation	18.8%	23.4%	.48
Satisfied with outcome	96.9%	96.8%	.95
Would choose elected surgery again?	90.6%	97.8%	.07

* Potency defined as at least moderate confidence to get and keep an erection based on SHIM questions #1.
† Defined as patients answering positively when asked if they now have problems achieving erections following surgery. Question is outlined in Appendix 1.
‡ Defined as patients stating that the penis has a curve or pulling sensation with erection based on question outlined in Appendix 1.
§ Defined as patients stating that they have noticed *any* decrease in glans filling based on question outlined in Appendix 1

overall success rate of 88% using either dorsal or ventral onlay techniques.[12] Similarly, Barbagli et al reported an 85% success rate for patients undergoing dorsal buccal grafting with a mean follow-up of 42 months.[13] In a separate article, Barbagli found that EPA was significantly more successful than DBG.[8] Reconstruction with buccal grafts can have increased morbidity from the graft harvest. Postoperative pain in the mouth almost universally exceeds the perineal pain and requires longer courses of pain-relievers and a slower recovery time. Long-term complications, although usually mild, can include perioral numbness, persistent difficulty with mouth opening, and changes in salivary function.[14]

The rationale of those who prefer to avoid EPA primarily involves concerns about tethering or curvature with erections, erectile dysfunction, adverse changes in glans sensation or fullness.[7] These sexual side effects may be more commonly associated with transecting versus nontransecting EPA. Data from Chapman et al found that transecting urethroplasty in particular was a risk factor for postoperative sexual dysfunction (14.3% transecting EPA vs 4.3% nontransecting EPA, *P*= .008), with similar complication and overall success rates.[15] We report our results with transecting EPA, which may be the anastomotic urethroplasty technique most associated with sexual side effects, and buccal graft substitution urethroplasty. In comparison to the Chapman et al study, we found a higher rate of postoperative sexual side effects (difficulty with erections, penile tethering, sensation changes, etc.). In that study, adverse postoperative sexual changes that did not meet a threshold of >5 point loss in SHIM or result in significant patient bother was not deemed to be clinically significant, and thus not classified as de novo sexual dysfunction. In contrast, we had no mechanism to quantitatively measure patient bother associated with certain symptoms, or a comparative pre- and postoperative SHIM. Consequently, we had a lower threshold for classifying sexual dysfunction, resulting in a potential overestimate in the clinical significance of some of the sexual side effects (especially since the SHIM scores are acceptable in both groups).

Our data shows that with the exception of penile tethering, there were no statistically significant differences in any other sexual side effects. SHIM scores in those that experienced penile tethering was an acceptable 18.1 and comparable to the DBG cohort. Moreover, 76% of patients who experienced tethering reported completely satisfactory sexual activity. As such, the significance of the tethering is unclear and may not confer any clinical significance. The exceptionally high satisfaction rates in both groups, and the fact that 98% of patients who underwent an EPA would choose their surgery again, suggest that these side effects are not overly bothersome and are an acceptable trade-off for the ability to void without obstruction.

Five patients in our EPA cohort reported a cold glans, with none reported in the DBG group. Since the risk of cold glans after EPA has been implicated as factor influencing decision-making in favor of onlay graft repair even for very short strictures, we investigated these specific patients further (Table 3). Of these patients, 2 patients reported completely satisfactory sexual intercourse (based on SHIM question # 5) and did not report any bother associated with the cold glans. Three other patients had concurrent erectile dysfunction. One patient had inflatable penile prosthesis placed *prior* to EPA and another patient was managed with PDE5-inhibitor. Both reported that the cold glans did not decrease sexual satisfaction. A third patient was not sexually active and was not pursuing any treatment. Given that 4 out of 5 patients engaged in satisfactory sexual intercourse despite a reported cold glans, we feel the clinical significance of a cold glans and its effect on sexual satisfaction is unclear and should not deter the use of EPA.

Also notable in our results is the significantly higher rates of postvoid dribbling in the DBG group. We postulate that this is because a substitute material is unable to coapt to the same extent as native urethra that is circumferentially surrounded by corpus spongiosum. In our

Table 3. Patients reporting "cold glans" following EPA

Patient	Age at Surgery (Years)	Length Follow-Up (Years)	Stricture Length (cm)	Concurrent ED? (SHIM < 17)	Status at Last Follow-up
1	36	10	0.5	No	Sexually active with without assistance. Reports satisfactory sexual activity (SHIM question # 5)
2	50	11	3.5	Yes	Not sexually active. Not pursuing treatment
3	54	6	2.5	Yes	ED managed with Cialis. Reports "cold glans" does not interfere with sexual satisfaction.
4	70	11	3	Yes	IPP placed **prior** to EPA. Cold glans not bothersome and has satisfactory intercourse with IPP.
5	25	3	2.5	No	SHIM score of 25. Completely satisfied with sexual intercourse

experience, this is not typically a very troublesome side effect and can be well-managed when patients are instructed by manually expressing this urine from the perineum after each void. Cotter et al investigated the overall prevalence of postvoid dribbling following anterior urethroplasty, and found that the prevalence was fairly high at 40% postoperatively, with 6.3% reporting de novo symptoms.[16] In contrast to our experience, Cotter et al noted no difference in symptoms based on surgical approach.

This study is limited by its nonrandomized nature because we generally treat patients with longer strictures with DBG, while patients with shorter strictures are treated with EPA. However, our comparable outcomes with regards to sexual patient reported outcomes imply that a preferential substitution approach over EPA for short bulbar strictures may not be appropriate. Moreover, another critique may be that the DBG group has fewer patients. We found that this was largely due to the fact that the majority of our patients who underwent substitution urethroplasty were excluded due to prior urethroplasty, extension of stricture outside of the bulbar urethra, prior hypospadias repair, or need for concurrent partial stricture excision. Lastly, a number of questions within the surveys are not officially validated for urethroplasty. However, the questions asked have been previously published and we feel they still offer meaningful data regarding certain postoperative outcomes.[7,9] Also with regards to the questionnaire responses, we lack preoperative questionnaire data that can introduce recall bias, and there is a potential element of bias from those that did not complete the surveys. The strengths of our data include strict inclusion criteria and a high rate of compliance of our patients with follow-up. In addition, our assessment of long-term urinary and sexual outcomes including detailed validated instruments to assess voiding, sexual and ejaculatory function.

CONCLUSION

EPA and dorsal buccal graft urethroplasties both have excellent success rates and comparable side effects with only 2 exceptions: increased postvoid dribbling with DBG and increased incidence of penile tethering with erections with EPA. Both groups have very high satisfaction rates and 98% of patients who had an EPA would choose their surgery again. Overall PROM were similar regardless of approach, despite inherent differences in stricture length. We continue to favor substitution urethroplasty for the treatment of longer bulbar strictures. While shorter bulbar stricture are also technically amenable to substitution buccal graft urethroplasty, our data indicates that anastomotic urethroplasty, a technique considered to have a higher success rate, should not be avoided due to concerns of sexual side effects.

SUPPLEMENTARY MATERIALS

Supplementary material associated with this article can be found in the online version at https://doi.org/10.1016/j.urology.2019.02.042.

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EDITORIAL COMMENT

There is undeniable evidence that 1 unintended consequence of bulbar urethroplasty is sexual dysfunction. While the majority of patients return to baseline within 6-12 months, transient, but clinically significant, sexual dysfunction has been reported in up to 40% among experienced surgeons.[1] We owe it to our patients to counsel and set appropriate expectations regarding likelihood of erectile and ejaculatory dysfunction, penile shortening, cold glans, and altered sensitivity following bulbar urethroplasty. The current study, while retrospective, has a lengthy follow-up of greater than 6 years with an impressive amount of patient reported urinary and sexual function data following bulbar urethroplasty. Three takeaway points from this study: (1) bothersome postvoid dribbling is more common following buccal mucosa graft—likely resultant to a disruption of natural bulbar urethral elasticity and mucosa coaptation, (2) anastomotic urethroplasty is more susceptible to penile tethering—a consequence of lengthy excision of mid to distal bulbar strictures and/or inadequate urethral mobilization, and (3) even in those men with some element of persistent sexual dysfunction there was a high level of patient satisfaction following urethroplasty.

While we continue to debate the significance of urethral transection as a contributing factor to postop erectile dysfunction,[2,3] this series found no difference between cohorts with extended follow-up. Until there is high-level compelling evidence otherwise, anastomotic urethroplasty should continue to remain an excellent primary reconstructive solution for most mid to proximal bulbar urethral strictures <2-3 cm. We have found with adequate mobilization to the penoscrotal junction that the redundant urethral elasticity of the mid to proximal bulb allows for a tensionless anastomosis without significant loss of penile length or tethering. Additional maneuvers which may reduce associated sexual side effects include sharp midline division and suture reapproximation of the bulbospongiosus muscle (ejaculatory dysfunction), spongiosal sparing 2-layer anastomosis (cold glans), minimizing extensive deep dissection within the intracrural space and cavernosal nerve injury (erectile dysfunction), and avoiding division of the central perineal tendon and damage to the perineal nerve (sensory and ejaculatory dysfunction).

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AUTHOR REPLY

We agree with the points made by the author of the editorial comment. Most bulbar strictures are within the mid-proximal bulbar urethra. For proximal strictures, our favored approach early in our series was to transect the urethra under the bulb, which included division of the bulbar arteries, dorsally spatulate both segments after stricture excision, and then perform a 1-layer primary anastomosis. This remains our preferred approach for dense proximal bulbar strictures that extend into the membranous urethra. However, for other bulbar strictures, we shifted toward an oblique transection of the urethra distal to the bulbar arteries with preservation of bulbar artery flow into the proximal bulb. After stricture excision, we dorsally spatulate the proximal segment to 30+ French, spatulate the distal segment, and then do a 2-layer repair. The objective is to restore proximal bulbar arterial blood flow within the corpus spongiosum.

Our series included both anastomotic urethroplasty techniques. We are now carefully reviewing this group, and our recent sub-set analysis suggests that when we can preserve the bulbar arteries and perform a 2-layer repair, this is associated with a reduced risk of sexual dysfunction. Although this was not reported as a part of our current paper, this finding is in line with the comments that certain technical maneuvers and nontransecting techniques when appropriate, may reduce the risk of sexual complications.

Since patients were not randomized to anastomotic versus dorsal buccal substitution urethroplasty, and the mean stricture length was longer in our patients that underwent dorsal buccal repair, we reported our data as an analysis of 2 techniques rather than a direct comparison. However, the fact that we noted similar rates of sexual dysfunction where the anastomotic group contained many patients that had bulbar transection and 1 layer suggests that if these bulbar artery sparing modifications truly reduce the rate of sexual dysfunction, this would further support the editorial comment that anastomotic urethroplasty should continue to remain an excellent primary reconstructive solution to shorter bulbar strictures.

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