
Long-Term Followup for Excision and Primary Anastomosis for Anterior Urethral Strictures

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Purpose: We report our experience and long-term followup of patients undergoing excision and primary anastomotic reconstruction for anterior urethral strictures.

Materials and Methods: From July 1986 to May 2006 the charts of 260 patients who underwent excision with primary anastomosis at our center for bulbar urethral stricture were reviewed. Patient age ranged from 14 to 78 years (mean 38.4), stricture length ranged 0.5 to 4.5 cm (mean 1.9). Patients who had surgery within the last 5 years were contacted by telephone if their 6-month postoperative cystoscopic evaluation was patent and they had not visited the clinic afterward.

Results: After a mean followup of 50.2 months 257 patients (98.8%) were symptom-free and required no further procedures. Recurrent stricture occurred early in 2 patients and late in 1 patient. Two patients opted for intermittent dilations, and a single direct visual internal urethrotomy was performed in 1 patient 4 years postoperatively. One of the patients who elected dilation subsequently elected urethral reconstruction, which was done successfully. Complications encountered were position related neuropraxia in 9 (3.4%), early urinary tract infection in 13 (5%), chest related in 5 (1.9%), scrotalgia in 4 (1.5%) and wound related in 4 (1.5%). All resolved within the early postoperative period. Erectile dysfunction was encountered in 6 (2.3%) patients, of whom 4 had a history of significant straddle trauma, 4 responded well to oral pharmacotherapy and 1 elected to not have the erectile dysfunction treated.

Conclusions: Excision with primary anastomosis for anterior urethral stricture has a high success rate of 98.8% with durable long-term results in most patients. Complications are few, of short duration and self-limited. Where applicable, we believe that the procedure clearly is the choice for short anterior urethral strictures.

Key Words: urethra, urethral stricture, reconstructive surgical procedures

In the management of urethral strictures the length, site, depth and number of strictures are taken into account. In short bulbous strictures with superficial spongiofibrosis, endoscopic incision yields acceptable results of 60% after 48 months of followup. However, repeated urethral endoscopic incisions have a poor success rate.¹ Other risks of apparently minimally invasive therapy for short bulbous strictures are increasing the length and density of spongiofibrosis making definitive surgical intervention more complex,² bleeding, risks of repeated anesthesia, and the cost of repeated procedures compared to the onetime open surgery.³ In this series we update our results on the use of excision and primary anastomoses for short bulbous urethral strictures.⁴

MATERIALS AND METHODS

We conducted a retrospective chart review of 260 patients with bulbar urethral strictures who had been operated on between July 1986 and May 2006 by 3 different surgeons at the same center who applied similar surgical principles. During the same time frame a total of 1,195 other anterior urethral reconstructions were performed. Our referral population consists only of 15% local referrals, the rest are regional or out of country referrals. Pelvic fracture urethral distraction defects were excluded, as they are believed to represent totally different pathology. Likewise, patients receiving an augmented anastomosis were excluded as that was believed to represent a totally different procedure. Preoperative evaluation included history and physical, and dynamic retrograde and voiding urethrograms. Direct visualization of the stricture by urethrocystoscopy was done preoperatively as well as intraoperatively to accurately assess the spongiofibrosis. Unfortunately, absolute accurate demonstration of spongiofibrosis is impossible with the technology at hand. In our hands the combination of cystoscopic appearance as well as radiographic appearance seems to serve us well. A postoperative voiding trial with contrast at 3 weeks was done in all patients, and subsequently urethroscopy was done at 6 months. Patients who had surgery in the last 5 years were contacted by phone and a questionnaire was completed to include urinary tract symptoms or infec-

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See Editorial on page 1609.

tion, medications, interventions, and complications. During that period 60 patients were contacted. Culture specific antibiotics were used to sterilize the urine according to the culture done preoperatively, and additional doses were started the day of surgery, or 24 hours earlier if the patient had a suprapubic tube.

The standard surgical technique of excision and anastomosis is applied while the patient is carefully positioned in exaggerated lithotomy. Adequate urethral mobilization is required, extending in some cases to the penoscrotal junction distally, and perineal body proximally. The area of fibrosis is completely excised, and the healthy ends are then spatulated.

For strictures distal to the bulbomembranous junction and thus in the body of the corpus spongiosum, a 2-layer widely spatulated anastomosis is performed with the urethral epithelium closed with 6-zero polyglactin suture, and the body of the corpus spongiosum closed with 3-zero and 4-zero PDS suture.

For strictures that begin proximally at the bulbomembranous junction, a single layer anastomosis of 4-zero monofilament absorbable suture is performed. In virtually all cases of very proximal strictures, the intracorporal space is developed, to shorten the path of the corpus spongiosum, and the bulbospongiosum is released or as mentioned completely detached. During this step, the triangular ligament is divided, and using a scalpel, the intracorporal space is developed. In patients with severe straddle trauma development of the space can be difficult because the space often is obliterated.

We prefer a 14Fr or smaller caliber silicon stenting catheter and a 16Fr diverting suprapubic tube, as well as perianastomotic and subcutaneous suction drains that remain for 2 to 3 days. Patients are ambulated on the second postoperative day and can be discharged that day on suppressive antibiotics until the time of the voiding trial. Our postoperative management is entirely based on surgeon preference and prejudice. Unfortunately optimal postoperative management of these patients has not been defined by outcomes based data.

Surgical failure of the procedure is defined as need for any intervention postoperatively except for the scheduled followup endoscopy. Followup endoscopy is done with either a 17Fr flexible cystoscope or in some cases a 7.5Fr pediatric cystoscope. If the pediatric scope is used, bougie a boule is used for calibration. In no case was dilation with either cystoscope or instrument done in these patients except as already noted for failure.

RESULTS

Patient age ranged from 14 to 78 years (mean 38.4). A total of 94 patients (36%) had a history of trauma involving the bulbar urethra, most commonly straddle injury, and 25 (10%) patients had a history of urethral instrumentation or catheterization as the insulting etiology. A previous history of recurrent urinary infections preceding the diagnosis of stricture was noted in 10 patients (3.8%). In these patients UTI heralded the presence of stricture. In 127 patients (48.8%) no cause for stricture could be identified.

Stricture length ranged from 0.5 to 4.5 cm (mean 1.9). Six patients had strictures 3.5 cm or longer, 2 of whom were prepared for buccal graft augmentation urethroplasty, and

the decision was changed based on intraoperative findings. Treatment before the current presentation consisted of urethral dilation and DVIU in 87 patients (33.5%), urethral dilations in 38 (14.8%), DVIU at least once in 21 (7.9%) and failed open urethral reconstruction performed elsewhere in 25 (10%). A total of 80 patients (30.8%) did not have any previous intervention at the time of evaluation. Postoperative complications encountered were position related neuropraxia in 9 (3.4%). Only 1 patient required neurological evaluation for back pain that he also had preoperatively and he was managed conservatively. Patients with neuropraxia had either numbness of the dorsum of the feet/foot or tingling. In all patients symptoms resolved in less than 48 hours and did not require intervention. We do not believe, in these patients, that neuropraxia is due to large nerve compression or stretch, as the pattern does not comply with major innervation areas and there is not motor involvement. Hence, we now believe that it may be due to local pressure on the dorsum of the feet, because in exaggerated lithotomy the weight of the leg, for the most part, is supported there. Early symptomatic UTI occurred in 13 (5%) patients. There were 5 (1.9%) patients who had postoperative atelectasis. Scrotalgia bothered 4 (1.5%) patients and was relieved by analgesics. Wound related complications in 4 (1.5%) patients included hematoma in 2 and suture breakdown in 2. Delayed bowel function was encountered in 2 (0.7%) patients. None of the patients in the series required prolongation of the catheter beyond the planned voiding urethrogram and trial.

After a mean followup of 50.2 months (range 6 to 122) 64 patients (24.6%) had a 5-year followup or more and 257 (98.8%) had a widely patent anastomosis on cystoscopy with minimal or no urinary tract related symptoms requiring further investigation. Our success rate is based on the best followup we can achieve. We recognize other published literature report lower success rates.⁵⁻⁷ The results of excision and primary anastomosis have been consistently excellent throughout the literature. In a study by Santucci et al a 95% success rate was reported in 168 patients with mean followup of 70 months.⁸ Michaeli et al also had similar results with 93% success rate in 74 patients with mean followup of 60 months.⁹ However, with the data we had to analyze, the success rate appears accurate and would support the other series which also report excellent success, albeit a lower percentage. Stricture recurred in 3 patients (1.2%). The time of recurrence of the stricture was early in the first year in 2 patients, and after 4 years in the third patient. The former patients elected an intermittent dilation protocol while the later responded to a single DVIU. One of the patients who elected dilation has subsequently elected urethral reconstruction which has been done successfully by us. Newly developed erectile dysfunction attributed to the surgery occurred in 6 patients (2.3%). Of those patients 4 had sustained severe straddle trauma to the perineum and 1 had adequate erections early postoperatively followed by erectile dysfunction. All were offered trials of oral pharmacotherapy. Four had a satisfactory response and 1 preferred not to have therapy. Lower urinary tract symptoms were reported in 5 patients and urethroscopic evaluation revealed a patent urethra. One patient had dysfunctional voiding diagnosed by urodynamic studies. He did not have any evidence of stricture on repeat cystoscopy.

DISCUSSION

With the advent of new techniques for the management of anterior urethral strictures such as laser urethral incision, urethral stenting, and multiple tissue transfer, the gold standard remains excision of the stricture with the anastomosis of the healthy spatulated ends in the appropriately selected cases. Excision and primary anastomosis has been used to repair urethral strictures since 1883 by Heuser, and modified by Marion in 1912 and Heitz-Boyer in 1922.¹⁰ Three surgeons in this study followed similar surgical principles with the technique previously described and the results were consistent in different hands.

In this study 101 (39%) of the patients had previously had multiple failed attempts of dilation and/or DVIU, and despite this fact, surgical outcomes were the same. Those patients were better served by a definitive surgery rather than multiple sessions of minimally invasive yet less successful procedures. The role of DVIU in bulbar strictures has been outlined by Pansadoro and Emiliozzi.¹¹ In 224 patients 68% had recurrence after a single DVIU. Those who did not fail had wide caliber strictures more than 15Fr and a single stricture less than 1 cm in length. DVIU had similar results as dilatation.¹² One study suggests that the treatment for short bulbous urethral strictures with primary reconstruction is, in the long-term, less costly than treatment with DVIU.³ We regard these to be in virtual agreement as to prediction of ultimate success of dilation or internal urethrotomy. Their findings support our previously existing belief regarding the subject. Thus, 30% of patients were believed to be poor candidates for dilation and/or internal urethrotomy and were not offered those procedures. The additional support of our cost analysis has served to further bolster these opinions and, thus, our pattern of reconstruction in all such patients.

In our opinion, the stricture length manageable by excision and primary anastomosis is best in the 1 to 2 cm range. Strictures more than 2 cm in length can be addressed with more extensive urethral mobilization. This is true for proximal bulbar strictures in which the proximal urethral flap is short and can survive the sacrifice of the proximal blood supply, and the distal urethral flap is long and can be freed up to the penoscrotal junction without ischemic edges. On the other hand in mid or distal bulbar strictures the bulbar arteries, which are essential to supply the longer proximal flap, limit the extent of proximal mobilization. Also extensive distal mobilization beyond the penoscrotal junction can lead to penile curvature.

In 6 patients in this series stricture length was 3.5 to 4.5 cm, and at the time of urethral mobilization, the patients were found to have what we have called a steep perineum, meaning that significant length was achieved after the intercrural space was developed, and the 2 ends of the urethra were approximated without any tension. However, in our experience this favorable anatomy is unpredictable from preoperative assessment.

Morey and Kizer reported a 91% success rate in the management of 11 strictures within the range of 2.6 to 5.0 cm at the proximal bulbous urethra.¹³ The strictures suitable for extended anastomotic approach occurred in young sexually active men, with maximal urethral vascularity and elasticity. The authors suggested other morphomet-

ric factors that allowed for more aggressive mobilization and more elastic spongy tissue for mobilization.

Time to recurrence of stricture was within the first year of followup in 2 patients, and 1 patient had resticture after 4 years. The latter had a good response on DVIU. Based on this, our current followup protocol is to perform urethros-copy at 6 months and to have the patients visit for subjective evaluation and urinalysis at 18 months after surgery and then on an as needed basis. Patients are asked to return if they have urinary symptoms or recurrent urinary infections and they are counseled on the possibility of late failures. Any late occurrence of voiding symptoms is investigated with a repeat endoscopy.

Erectile dysfunction developed in 6 patients (2.3%), of whom 4 (65%) had a history of severe straddle trauma and lost rigidity within months of the surgery. In patients who have similar straddle injuries, we recommend discussing the risk of deterioration of their erections, because they appear to be at higher risk for the development of erectile dysfunction attributed to surgery. Our assumption is that the straddle trauma in some way complicates the dissection and, thus, predisposes to the injury. The precise cause of ED was not investigated in any patient. However, the fact that 4 of the patients responded to oral therapy might suggest against nerve injury.

CONCLUSIONS

Excision and primary anastomosis for anterior urethral stricture has an excellent success rate with durable long-term results in most patients. Short and long-term morbidities are few and usually self-limited. Patients with significant straddle trauma are at increased risk for postoperative erectile dysfunction. Where applicable we believe that the procedure clearly is the choice for short length anterior urethral strictures. There are emerging data from isolated centers which claim better success for reconstruction using a short buccal mucosa graft onlay. To our knowledge these data are not widely substantiated at this time but certainly must be watched as further data emerge.

Abbreviations and Acronyms

DVIU	=	direct visual internal urethrotomy
ED	=	erectile dysfunction
UTI	=	urinary tract infection

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EDITORIAL COMMENT

Other expert surgeons have published similar series, but seldom with a 99% success rate. This is important because readers must understand the range of results that they might see. In our series of local patients with virtually 100% local followup we had a 10% failure rate,¹ another group had a 5% failure rate (reference 8 in article) and Andrich et al had as high as a 14% failure rate when patients were followed for as long as 15 years (reference 7 in article). Most

interesting would be to understand just what explains a 15-fold difference in recurrences among different reconstructive urology centers. Is it adequacy of followup, technique or the Stradivarius effect?*

An expert group like this which has performed more than 1,000 urethroplasties might well have created a technique so robust that it beats other successful results by 5 to 15-fold. But could there be other explanations? For one, 85% of the patients in this series are from out of town, and not all of these return to Virginia for followup. In fact, only 60 patients were successfully contacted by telephone/mail followup efforts. What of the others? Could they have had recurrences of which the authors were not aware? Of course. It is important for readers to understand that they themselves might not be able to expect a 1% failure rate after this procedure, whether it is the "Stradivarius effect" or a good old fashioned artifact of followup. "Your results may vary. . ."

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1. Al-Qudah HS and Santucci RA: Buccal mucosal onlay urethroplasty versus anastomotic urethroplasty (AU) for short urethral strictures: which is better? *J Urol, suppl.*, 2006; **175**: 103, abstract 313.

* Antonio Stradivari was a Venetian violin maker in the 1600s and early 1700s. Despite the efforts of many excellent violin makers throughout world history, few if any have been able to recreate the excellent results of his violin making efforts. This does not mean that Stradivari did not actually have these excellent results. It just means that the rest of the world lags behind Stradivari in technique, materials selection or something.