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# Long-Term Followup of Bulbar End-to-End Anastomosis: A Retrospective Analysis of 153 Patients in a Single Center Experience

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**Purpose:** We performed a retrospective evaluation and statistical analysis of outcome in patients who underwent bulbar end-to-end anastomosis.

**Materials and Methods:** We reviewed 153 patients with an average age of 39 years who underwent bulbar end-to-end anastomosis between 1988 and 2006. Mean followup was 68 months. Stricture etiology was unknown (62.7%), catheter (14.4%), blunt perineal trauma (11.7%), instrumentation (9.8%), radiotherapy (0.7%) and infection (0.7%). Stricture length was 1 to 2 cm (in 59.5%), 2 to 3 cm (37.9%), 3 to 4 cm (1.9%) or 4 to 5 cm (0.7%). A total of 90 patients (59%) underwent dilation, internal urethrotomy, urethroplasty or multiple procedures before being referred to our center. Clinical outcome was considered a treatment failure when any postoperative instrumentation was needed. The prevalence of postoperative sexual dysfunction was investigated using a nonvalidated questionnaire.

**Results:** Of 153 cases 139 (90.8%) were successful and 14 (9.2%) were treatment failures. Treatment failure was managed with urethrotomy in 9 cases, end-to-end anastomosis in 2, buccal mucosal graft urethroplasty in 1 and 2-stage repair in 2. Of 14 cases of failure 12 had a satisfactory final outcome, 1 is still waiting for the second stage of urethroplasty and 1 underwent definitive perineostomy. There were 14 patients (23.3%) who experienced ejaculatory dysfunction, 1 (1.6%) a cold glans during erection, 7 (11.6%) a glans that was neither full nor swollen during erection and 11 (18.3%) had decreased glans sensitivity. No patients complained of penile chordee or impotence.

**Conclusions:** Bulbar end-to-end anastomosis has a success rate of 90.8%. Most patients were satisfied with the surgical outcome despite postoperative complications such as ejaculatory dysfunction, a glans that was neither full nor swollen during erection, or decreased penile sensitivity.

*Key Words:* urethra; urethral stricture; anastomosis, surgical; treatment outcome;

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Surgical treatment of urethral strictures includes numerous options such as dilation, vision internal urethrotomy, stent and reconstructive surgical techniques. Peterson and Webster suggested that no one technique is appropriate for all stricture diseases and the urologist must be familiar with various surgical techniques to deal with any condition of the urethra during surgery.<sup>1</sup> In the management of urethral strictures the etiology, site, length and density of spongiofibrosis are taken into account. Basically the surgical technique used in the repair of the bulbar urethral stricture might be selected according to stricture length.<sup>2</sup> Short uncomplicated strictures are generally amenable to complete excision with primary anastomosis.<sup>1,2</sup> Longer strictures are managed using augmented roof strip anastomosis or substitution onlay graft urethroplasty.<sup>1,2</sup> Finally, for patients with strictures associated with local adverse conditions, 2-stage urethroplasty might be suggested.<sup>1,2</sup> End-to-end anastomosis is the most successful treatment for bulbar urethral strictures with a reported high success rate and low postoperative morbidity.<sup>3-6</sup> We performed a retrospective evaluation and statistical analysis

of outcome in patients who underwent bulbar end-to-end anastomosis in terms of success rate and morbidity including urinary and sexual function.

## MATERIALS AND METHODS

From 1988 to 2006 a total of 153 patients with an average age of 39 years (range 14 to 78) underwent bulbar end-to-end anastomosis. Patients with lichen sclerosus or in whom hypospadias repair failed were excluded from analysis. All the data regarding these 153 patients are available at [www.urethralcenter.it](http://www.urethralcenter.it). Preoperative evaluation included clinical history, physical examination, urine culture, residual urine measurement, uroflowmetry, and retrograde and voiding cystourethrography. Since 1998 urethral ultrasound was also performed in all patients. Stricture etiology was unknown in 96 (62.7%) cases, catheter in 22 (14.4%), blunt perineal trauma in 18 (11.7%), instrumentation in 15 (9.8%), radiotherapy in 1 (0.7%) and infection in 1 (0.7%). Stricture length was 1 to 2 cm in 91 patients (59.5%), 2 to 3 cm in 58 (37.9%), 3 to 4 cm in 3 (1.9%) and 4 to 5 cm in 1 (0.7%). A total of 90 patients (59%) underwent dilation (1.3%), internal urethrotomy (35.9%), urethroplasty (3.3%) or multiple treatments (18.3%) before referral to our center. The number of prior urethrotomies ranged from 1 to 5 (average 1.7). All surgical procedures were performed by the same uro-

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gist (GB) without significant changes in standard technique.<sup>7</sup> Patients were discharged from the hospital 3 days after surgery and voiding cystourethrography was performed 2 weeks later. Clinical outcome was considered failure when any postoperative instrumentation was needed including dilation. Uroflowmetry and urine culture were repeated every 4 months in the first year and annually thereafter. When symptoms of decreased force of stream were present and uroflowmetry was less than 14 ml per second, urethrography, urethral ultrasound and urethros-copy were repeated. Average followup was 68 months (range 12 to 218).

The prevalence of postoperative sexual disorders was investigated using a nonvalidated telephone questionnaire administered by a neutral person who was not part of the hospital staff. The questionnaire was administered to 60 patients selected according to age 20 to 50 years old, no diabetes or vascular diseases present, no previous failed open urethroplasty and no further surgery required following anastomotic urethroplasty (see Appendix). The questionnaire included 5 questions to investigate modifications in ejaculation, 7 questions on the presence of neurovascular penile disorders and 2 questions to evaluate final patient satisfaction or dissatisfaction following surgery. We used this questionnaire instead of the International Index of Erectile Function because our goal was to assess the subjective afferent function of penis innervation and ejaculatory dysfunction.

In terms of statistical analysis the Student t test was used to compare patient age according to surgical intervention outcome. Categorical data were analyzed with the chi-square test and Fisher's exact test. The level of statistical significance was set at  $p < 0.05$ . All calculations were performed with SPSS® release 13.0.

## RESULTS

Of 153 cases 139 (90.8%) were treatment successes and 14 (9.2%) were failures. Based on patient age the success rate was 91.3% in men 14 to 49 years old, 85.7% in men 50 to 69 years old and 100% in men older than 70 years. Based on stricture etiology the success rate was 100% in cases of stricture following infection (1), 93.3% in strictures following urethral instrumentation (15), 92.7% in stricture of unknown etiology (96), 88.9% in traumatic strictures (18), 86.4% in strictures caused by a catheter (22) and 0% in strictures following radiotherapy (1). Based on stricture length the success rate was 100% in patients with stricture 3 to 5 cm (4), 93.4% in those with 1 to 2 cm stricture (91) and 86.2% in those with 2 to 3 cm stricture (58). Based on having received treatment before surgery, the success rate was 100% in patients who underwent prior urethroplasty (5) or dilation (2), 94.5% in those who underwent urethrotomy (55), 92.1% in patients who had not undergone previous treatment (63) and 78.6% in those who had undergone multiple treatments (28). Eight patients (4.8%) had postoperative fistula at the first radiological investigation 2 weeks after surgery. In all of these patients the fistula was spontaneously closed by leaving a catheter in place for 14 days. No patients with an early postoperative fistula had stricture recurrence.

The mean age of patients in whom treatment failed was not statistically different from the mean age of those with

successful outcomes ( $42.86 \pm 15.67$  SD vs  $37.78 \pm 15.91$ , respectively), even if this latter group had a trend toward a lower mean age. Furthermore, previous treatments did not correlate with outcome ( $p = 0.345$ ) as well as stricture length when it was split into 3 categories of 1 to 2 cm, 2 to 3 cm and more than 3 cm. The 14 cases of treatment failure were homogeneously distributed over time. Of these 14 cases 7 (50%) experienced failure in postoperative year 1, 4 (28.5%) during postoperative year 2, 1 (7.1%) during year 3 and 2 (14.2%) after postoperative year 3. At the beginning of the learning curve (from March 1988 to March 1998) 23 of 25 cases were considered successful and 2 were considered treatment failures. At the end of the learning curve (from October 2004 to March 2006) 22 were considered successful and 3 considered treatment failures. Therefore, there was no difference in outcome between patients treated at the beginning of the learning curve and those treated at the end. Treatment failure was managed with urethrotomy in 9 cases, end-to-end anastomosis in 2, buccal mucosal graft urethroplasty in 1 and 2-stage repair in 2 cases. Of 14 failures 12 had a satisfactory final outcome, 1 is still waiting for the second stage of urethroplasty and 1 underwent definitive perineostomy.

With regard to the prevalence of postoperative sexual function disorders, 12 patients (20%) experienced decreased ejaculation force and in 2 patients (3.3%) ejaculation was possible only by manually compressing the perineum at the level of the urethral bulb. One patient (1.6%) had a cold glans during erection, 7 (11.6%) had a glans that was neither full nor swollen during erection and 11 (18.3%) had decreased sensitivity of the glans or distal penile shaft. No patients complained of penile chordee or impotence. Of 60 patients evaluated using a nonvalidated telephone questionnaire, 2 (3.3%) declared that they were dissatisfied with the outcome of the surgery, 1 because of postoperative pain and 1 because of the cold glans. Patient dissatisfaction was tested using a scale from 1 (dissatisfied) to 4 (very satisfied) (see Appendix).

## DISCUSSION

Recently the widespread use of end-to-end anastomosis has become a contentious issue in the literature, regarding, above all, certain aspects of this surgical technique.<sup>8-10</sup>

### Patient Age

Santucci et al reviewed 70 urethroplasties performed on patients older than 64 years (range 65 to 82) including 30 anastomotic urethroplasties.<sup>5</sup> The incidence of resticture was compared to a group of similar patients younger than 65 years and success rates were found not to be statistically different.<sup>5</sup> In our experience 139 patients younger than 65 years (mean age 35, range 14 to 63) had a success rate of 89.9% and 14 patients older than 65 years (mean age 71, range 66 to 78) had a success rate of 100%. Thus, the results seem to confirm that patient age is not a factor in the success rate and that end-to-end anastomosis should not be withheld from patients on the basis of age.

### Stricture Length

Recently the ideal stricture length for end-to-end anastomosis has become a contentious issue.<sup>8,9</sup> Guralnick and Webster as-

sented, without validation from data, that this operation should be limited to stricture of 1 cm or less, as excision of a 1 cm urethral segment with opposing 1 cm proximal and distal spatulations results in a 2 cm urethral shortening, which may be accommodated by the elasticity of the bulbar urethra without chordee.<sup>8</sup> Excision of a longer urethral segment risks penile shortening or chordee.<sup>8</sup> On the other hand Morey and Kizer reported on a selected cohort of 22 patients (excluding those with hypospadias or pelvic trauma) with proximal bulbar urethral strictures longer than 2.5 cm treated with an extended anastomotic approach, suggesting that urethral reconstructability is proportional to the length and elasticity of the distal urethral segment.<sup>9</sup> They reported a 91% success rate and with no increase in erectile complaints compared to shorter strictures, concluding that selected strictures longer than 2.5 cm can be successfully treated using this technique.<sup>9</sup> In our study the interpretation of the success rate of urethroplasty according to stricture length was controversial. Of 153 patients we used end-to-end anastomosis in 91 (59.5%) with strictures shorter than 2 cm and in 58 (37.9%) with strictures ranging from 2 to 3 cm, using this technique in only 4 patients (2.6%) with strictures longer than 3 cm. The success rate of 93.4% for strictures less than 2 cm was not statistically significantly different from the success rate of 87.1% for strictures longer than 2 cm ( $p < 0.25$ ). Surprisingly the success rate was 100% for strictures 3 to 5 cm in length (4 cases). At our center we performed 375 single stage bulbar urethroplasties ([www.urethralcenter.it](http://www.urethralcenter.it)) including end-to-end anastomosis (165 cases), augmented anastomotic repair (40 cases) and onlay graft urethroplasty (170 cases). We stringently selected only 4 patients with stricture longer than 3 cm for anastomotic repair instead of substitution urethroplasty.

### Previous Treatments

In the literature interpretation of the urethroplasty success rate based on previous treatment was controversial.<sup>4,6,11,12</sup> In our study 90 of 153 patients (58.8%) underwent prior single or multiple treatments while 63 patients (41.2%) had no previous treatment. The only group of patients who had a lower success rate (78.6%) had undergone multiple treatments (dilation, urethrotomy or urethroplasty), whereas the other groups showed similar success rates ranging from 92.1% to 100% without any statistical significance.

### Sexual Dysfunction

#### Following End-to-End Anastomosis

Al-Qudah and Santucci suggested that end-to-end anastomosis is controversial in the treatment of urethral strictures ranging from 0.5 to 3.0 cm.<sup>10</sup> They presented 47 short urethral strictures treated with end-to-end anastomosis or buccal mucosal graft urethroplasty and compared the results to determine the best technique.<sup>10</sup> The recurrence rate was 7% in those patients who underwent end-to-end anastomosis and 0% in patients who underwent buccal mucosal graft urethroplasty.<sup>10</sup> Complications including chordee and erectile dysfunction occurred in 18% of the patients after anastomotic repair.<sup>10</sup> We investigated the prevalence of postoperative sexual dysfunction in a series of 60 patients, excluding those in whom sexual dysfunction could be related to age, previous surgery, or diabetes or neurovascular disease. No patient complained of penile chordee and impotence. This is probably because we used this technique in the

majority of patients with strictures shorter than 3 cm to avoid extending the urethral mobilization more distally (to avoid chordee) or proximally (to avoid damage to the neurovascular bundle). Nevertheless, 23.3% of patients had postoperative ejaculation difficulty and 31.6% had neurovascular disorders of the glans or distal penile shaft. These minor postoperative dysfunctions did not modify overall satisfaction as only 3.3% of patients declared that they were unsatisfied with the outcome of the surgery. This optimistic patient evaluation of the surgery is also probably influenced by good outcome in terms of urinary function. The most frequent postoperative ejaculation disorder was decreased force of ejaculation jet (20%) or semen sequestration in the urethral bulb (3.3%). Yucel and Baskin reported that perineal nerves innervate the bulbospongiosum muscles and send branches to penetrate the corpus spongiosum.<sup>13</sup> Rhythmic contractions of the bulbospongiosum muscles expel semen from the urethra and have an important role in expelling urine, or preventing urine or semen sequestration in the urethral bulb.<sup>13</sup> Most likely surgical damage to the branches of the perineal nerves or bulbospongiosum muscles may have a role in determining the loss of efficient bulbar urethral contraction, causing difficulties in expelling semen and urine.<sup>13</sup> The most frequent postoperative neurovascular disorders were decreased sensitivity of the glans or distal penile shaft (18.3%), or vascular deficiency of the glans penis (13.3%). Further studies are necessary to clarify the etiology of these neurovascular disorders and identify the modality to fully preserve the neurovascular supply to the glans and penile shaft during end-to-end anastomosis.

### Learning Curve

During the last 19 years we performed 165 end-to-end anastomoses, of which 153 were selected for this study. The cases in which treatment failed were distributed homogeneously during this period, and there was no difference in outcome between the first 25 cases treated at the beginning of the learning curve and the last 25 treated at the end of the learning curve. This is probably because end-to-end anastomosis is a simple procedure that does not require any particular surgical expertise as in the use of onlay grafting procedures. In fact, we found differences in the outcomes of the 2 bulbar onlay grafting urethroplasties, 1 using skin and the other using buccal mucosa as substitute materials. Most treatment failure after dorsal skin graft urethroplasty occurred because the procedure was performed at the beginning of the learning curve, whereas buccal mucosal graft urethroplasty was performed at the end of the learning curve when numerous technical and surgical refinements had been made.<sup>14</sup>

Finally, we realized that one of the weaknesses of this study was the lack of sample size calculation to set the statistical power. Unfortunately, some statistical comparisons might be lost. This weakness was due to the nature of the investigation as a retrospective analysis of a case series.

### CONCLUSIONS

End-to-end anastomosis is an effective surgical option for patients with bulbar stricture despite the possibility of minor postoperative disorders affecting ejaculation or penile sensitivity. End-to-end anastomosis should not be withheld from patients on the basis of age. In our study the interpretation of the success rate according to stricture length was controversial. As

far as the relationship between prior treatments and surgical outcome, the only group of patients with a lower success rate was one which had undergone multiple treatments (dilation, urethrotomy or urethroplasty), whereas the other groups showed similar success rates without any statistical significance. Finally, the results of surgery are not influenced by a learning curve and cases of treatment failure were homogeneously distributed over time.

## APPENDIX

<p><b>Changes in Ejaculation</b></p> <p>Did you complain of ejaculation disorders after the surgery? Yes No</p> <p>Did you recognize changes in ejaculation after the surgery comparing it with your previous status? Yes No</p> <p>Does ejaculation occur with difficult stream? Yes No</p> <p>If Yes, what is the stream like? No stream Very poor spontaneous stream The stream occurs only by manually compressing the perineum</p> <p>Is the ejaculation difficulty present: Always Sometimes Seldom</p> <p>Did you have negative changes in the relationship with your partner due to difficult ejaculation? Yes No</p> <p>Did you have children after the surgery? Yes No</p> <p><b>Neurovascular Penile Disorders</b></p> <p>Did you complain of penile erection disorders after the surgery? Yes No</p> <p>Does your glans fully swell during erection? Yes No</p> <p>If No: Glans is not swollen Glans is partially swollen Glans is fully swollen at the beginning of erection, but it was not maintained fully swollen throughout the sexual activity Did you have negative changes in your sexual activity due to this problem? Yes No</p> <p>If Yes, what kind of problems did you recognize? Psychological problems Problems during vaginal intercourse Other minor problems</p> <p>Did you recognize a change in penile sensitivity after surgery? Yes No</p> <p>If Yes, where did you localize sensitivity changes? In the glans In penile skin In distal penile shaft Including all penile shaft</p> <p>What was the penile sensitivity like after surgery? Decreased Increased Not specifically altered</p> <p>Was the penile sensitivity changed in relation to: Touch Cold/hot All stimulus</p> <p>During the erection do you complain of cold glans? Yes No</p> <p>Did you have negative changes in your sexual activity due to this problem? Yes No</p>
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(appendix continued)

## APPENDIX continued

<p>If Yes what kind of problems did you recognize? Psychological problems Problems during vaginal intercourse Other minor problems</p> <p><b>Final Assessment of Surgery</b></p> <p>Are you satisfied of surgical outcome and what is your judgment of final results?</p> <table> <tr> <td>1. Not satisfied</td> <td>1. Negative</td> </tr> <tr> <td>2. Poor satisfied</td> <td>2. Poor</td> </tr> <tr> <td>3. Satisfied</td> <td>3. Good</td> </tr> <tr> <td>4. Very satisfied</td> <td>4. Excellent</td> </tr> </table> <p>If your answer was 1 or 2 Is it because you did not improve urinary function? Is it because your sexual activity was worsened? Would you repeat the surgery? Yes No</p> <p>If No, why? Due to postoperative pain Due to psychological problems Because the outcome was different from what I foresaw</p>	1. Not satisfied	1. Negative	2. Poor satisfied	2. Poor	3. Satisfied	3. Good	4. Very satisfied	4. Excellent
1. Not satisfied	1. Negative							
2. Poor satisfied	2. Poor							
3. Satisfied	3. Good							
4. Very satisfied	4. Excellent							

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