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Reconstructive Urology

Dorsal Onlay Skin Graft Bulbar Urethroplasty: Long-Term Follow-Up

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Abstract

Objectives: To report retrospectively long-term follow-up in a homogeneous group of patients who underwent dorsal onlay skin graft bulbar urethroplasty and to investigate which factors might influence long-term outcome.

Methods: Thirty-eight patients, with an average age of 43 yr, underwent dorsal onlay skin graft (#12 ventral penile skin and #26 preputial mucosa) bulbar urethroplasty from 1994 to 2000. Of 38 patients, 23 (60.5%) had undergone prior endoscopic procedures. Preoperative evaluation included clinical history, physical examination, retrograde and voiding urethrography, and urethral sonography. Three weeks after surgery, voiding cystourethrography was performed. Patients were followed-up with a clinical evaluation and specific diagnostic tests every 4 mo in the first year and every 12 mo thereafter. Clinical outcome was considered a failure when postoperative instrumentation, including dilation, was needed.

Results: Average follow-up was 111 mo (range, 80–149). Of 38 cases, 25 (65.8%) were successful and 13 (34.2%) failures. Patients with stricture length > 6 cm and a previous history of urethrotomies or dilatations seemed to have a higher risk of failure, but this observation was only a trend and did not reach levels of statistical significance.

Conclusions: Penile skin used as dorsal onlay graft for bulbar urethral reconstruction in a homogeneous series of patients showed a success rate ranging from 90% at short-term follow-up to 66% after long-term follow-up. There was no evidence for particular risk factors (length of stricture, number of dilatations and urethrotomies) for failure.

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1. Introduction

The treatment for urethral strictures includes numerous options, such as dilation, urethrotomy, stent, anastomotic urethroplasty, and surgical techniques using grafts and flaps. Moreover two-stage urethroplasty is suggested in patients with local adverse conditions. No one technique is appropriate for all stricture diseases. Skin graft had been used for a long time before the use of buccal mucosa became the gold standard for urethral reconstruction.

The development of dorsal onlay graft urethroplasty represents a further evolution of existing techniques that have been suggested for repair of urethral strictures. In 1979, Devine and collaborators [1] popularised the use of genital and extragenital free skin grafts for urethral reconstruction. In 1980, Monseur [2] first described a new approach to the urethra: opening the dorsal urethral surface and fixing the opened urethra over the underlying corpora cavernosa, and leaving a catheter in place for a long period of time so as to obtain regeneration of the urethral mucosa. In 1996, we combined Devine's technique with Monseur's and described a new technique for dorsal onlay graft urethroplasty [3,4]. In our technique, the bulbar urethra is dissected from the corpora cavernosa, rotated 180 degrees, and opened along its dorsal surface. Using the dorsal approach to the urethral lumen, we have described three different types of bulbar onlay skin graft urethroplasty, namely tube graft urethroplasty [3], augmented anastomotic repair [3,4] and dorsal onlay graft urethroplasty [4].

In the dorsal onlay skin graft urethroplasty, the bulbar urethra is rotated 180 degrees and opened along its dorsal surface [4]. The skin graft is fixed to the albuginea of the corpora, and the urethra is rotated to its original position to cover the graft [4]. Over time, this technique has become our favoured technique and new modifications have been suggested [5]. In 1998, we reported the short-term results of this type of urethroplasty: Of 31 patients, the technique was successful in 28 (90%) and failed in 3 (10%), with a mean follow-up of 21.5 mo [6]. In 2004, we reported the interim outcomes of dorsal onlay skin graft urethroplasty on 45 patients: 33 (73%) were considered successful and 12 (27%) failures, with a mean follow-up of 71 mo [7]. The aim of this study was to extend our previously published short-term follow-up [4,6,7] by reporting a long-term follow-up in a homogeneous group of patients who underwent dorsal onlay skin graft urethroplasty for urethral stricture so as to inform the specialist community and help in the counselling of patients. Finally, we tried to investigate which

factors might have influenced the long-term outcome and deterioration of the success rate.

2. Materials and methods

2.1. Patient population

A total of 38 consecutive patients with an average age of 43 yr (range, 17–73) underwent dorsal skin graft urethroplasty from 1994 to 2000 for bulbar urethral strictures. Preoperative evaluation included clinical history, physical examination, urine culture, residual urine measurement, uroflowmetry, and retrograde and voiding cystourethrography. Since 1998, urethral ultrasound had also been performed in all patients. The etiology of the strictures was unknown in 18 (47.4%) cases, trauma in 7 (18.4%), instrumentation in 6 (15.8%), catheter in 5 (13.2%), and infection in 2 (5.2%). Stricture length was 4 to < 5 cm in 14 patients (36.8%), 5 to < 6 cm in 8 (21.1%), 3 to < 4 cm in 7 (18.4%), 2 to < 3 cm in 5 (13.2%), and > 7 cm in 4 (10.5%). Twenty-three patients (60.5%) underwent dilation 1 (2.6%), internal urethrotomy 14 (36.8%), or associated treatments 8 (21.1%) before referral to our center. The number of urethrotomies performed prior to open repair ranged from 1 to 12 with an average of 3.3.

2.2. Surgical technique

A midline perineal-scrotal incision was made, the bulbospongiosum muscles were separated, and the bulbar urethra was dissected from the corpora cavernosa and rotated 180 degrees. The dorsal urethral surface was opened and the stricture length was intraoperatively evaluated. The urethra was moved to the right side, and the graft was sutured, splayed, and quilted over the corpora cavernosa by using 6-0 interrupted stitches. In 12 patients with strictures < 4 cm, an ovoid strip of skin was harvested from the ventral penile shaft. The harvesting site was closed with interrupted stitches. Dorsal skin incision to release tension was unnecessary. In 26 patients with strictures > 4 cm, a double circumferential subcoronal incision was made to harvest a longer preputial mucosa strip. The graft was deflated. The right urethral margin, including urethral mucosa, spongy tissue, graft, and albuginea, was sutured onto the right side of the graft by using interrupted stitches in a single layer. The left side of the graft was sutured to the left side of the urethra and the urethra was rotated over the graft. At the end of the procedure, the graft was completely covered by the urethra. A 16F silicone catheter was left in place. All surgical procedures were performed by the same urologist (G.B.).

2.3. Postoperative course and follow-up criteria

Patients were discharged from the hospital to home 3 d after surgery and voiding cystourethrography was performed 3 wk later. Patients received a tablet of ciprofloxacin (500 mg) die for 21 d. Clinical outcome was considered a failure when any postoperative instrumentation, including dilation, was needed. Uroflowmetry and urine culture were repeated every 4 mo in the first year and annually thereafter. When

symptoms of decreased force of stream were present and the uroflowmetry was less than 14 ml per second, retrograde and voiding urethrography, urethral ultrasound, and urethroscopy were repeated. The average follow-up in the entire series was 111 mo (range, 80–149).

2.4. Statistical analysis

A statistical analysis was done to investigate which factors might correlate with the outcome (success vs. failure). Age, stricture length, previous dilatations and/or urethrotomies, and time since the primary surgery were the variables assessed. Stricture length was split into three main groups to facilitate the statistical analysis: stricture length < 4 cm (group 1), stricture length ranging between 4 and < 6 cm (group 2), and stricture length \geq 6 cm (group 3). The Kaplan-Meier estimator was used to estimate failure-specific survival rates. Survival times were measured in months and were censored at the date of a patient being lost to follow-up or at the date of the last follow-up. A log-rank test was performed to compare event-free survivals. Odds ratios (OR; hazard ratios) with 95% confidence interval (95% CI) of failure were calculated with the use of the Cox regression model including as covariates: age, stricture length, and previous dilatations and urethrotomies. Student t test and chi-square test were used to compare basal characteristics of patients. Statistical significance was set at $p < 0.05$. All calculations were carried out with SPSS release 13.0 (SPSS Inc, Chicago, IL, USA).

3. Results

The results are shown as descriptive and statistical results.

Of 38 cases, 25 (65.8%) were considered successful and 13 (34.2%) failures. On the basis of patient age, the success rate was 69.9% in 16 men ranging from 17 to 49 yr, 61.1% in 8 men ranging from 50 to 69 yr, and 50% in 1 man older than 70 yr. On the basis of stricture etiology, the success rate was 100% in patients with strictures following infection (2 of 2 cases), 71.4% in traumatic strictures (5 of 7 cases), 66.7% in strictures following urethral instrumentation (4 of 6 cases), 61.1% in patients with strictures of an unknown etiology (11 of 18 cases), and 60% in strictures caused by a catheter (3 of 5 cases). On the basis of stricture length, the success rate was 100% in strictures ranging from 2 to 3 cm (5 of 5 cases), 64.3% in strictures ranging from 4 to 5 cm (9 of 14 cases), 62.5% in strictures ranging from 5 to 6 cm (5 of 8 cases), 57.1% in strictures ranging from 3 to 4 cm (4 of 7 cases), and 50% in strictures > 7 cm (2 of 4 cases). On the basis of having received treatment previous to the dorsal skin graft urethroplasty, the success rate was 80% in patients who had not undergone previous treatment (12 of 15 cases), 64.3% in patients who had undergone a urethrotomy (9 of 14 cases), and 50% in those who had undergone

associated treatments (4 of 8 cases). One patient (2.6%) showed a postoperative fistula at the first radiological investigation 3 wk following surgery. The 13 failures were treated with definitive perineal urethrostomy in 5 cases, two-stage repair in 4 cases, urethrotomy in 3 cases, and one-stage repair in 1 case. Of 8 patients who did not receive a definitive perineal urethrostomy, 6 had a satisfactory outcome at mean follow-up of 46.5 mo (range, 12–84), and 2 underwent definitive perineal urethrostomy.

The mean age of patients with success or failure was not statistically significant: 42.40 ± 17.032 standard deviation (SD) and 45.38 ± 14.835 SD, respectively. No difference was recorded regarding the length of the stricture and the number of dilatations and urethrotomies between the two groups of patients.

The success rate throughout the follow-up is shown in Fig. 1, which shows that the higher failure rate is recorded in the first 5 yr; after 5 yr a non-significant decrease in success rate was observed. No statistically significant difference was observed about the failure time with regards to the preoperative stricture length, the number of dilatations, and the number of urethrotomies (data are summarised in Figs. 2–4, respectively). However, patients with longer stricture length and a previous history of urethrotomies or dilatations seem to have a higher risk of failure, but this observation was only a trend and did not reach levels of statistical significance.

The Cox regression, which analyses the failure probability, showed instead an adjusted OR of 1.307 (95%CI, 1.108–1.542) for the number of urethrotomies performed before urethroplasty.

4. Discussion

The term “urethral stricture” refers to different pathologies with regards to anatomy, etiology,

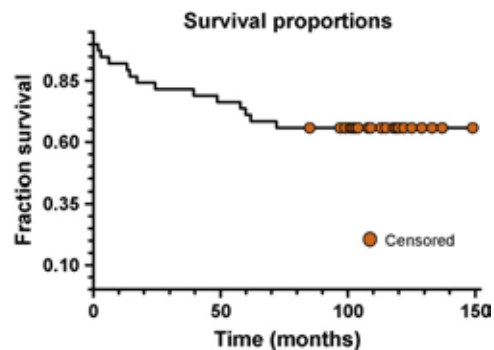


Fig. 1 – Accumulated survival rates. Survival time after intermediate dorsal onlay skin graft urethroplasty: mean, 109.1 mo (95% confidence interval, 90.9–127.3).

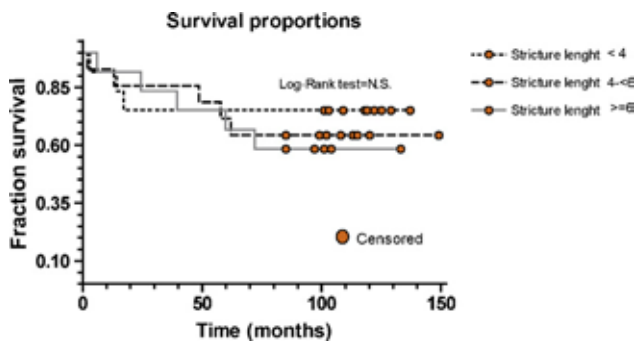


Fig. 2 – Accumulated survival rates. Survival time after intermediate dorsal onlay skin graft urethroplasty subdivided according to stricture length. Stricture length < 4 cm: mean, 105.6 mo (95% confidence interval [95%CI], 74.8–136.4); stricture length ranging between 4 and < 6 cm: mean, 108.9 (95%CI, 79.7–138.1); stricture length ≥ 6 cm: mean, 94.4 (95%CI, 67.1–121.6).

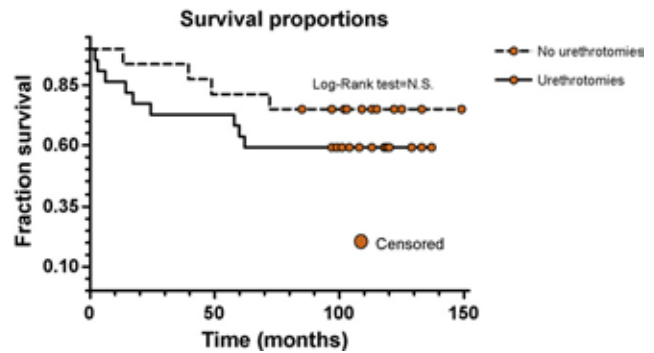


Fig. 4 – Accumulated survival rates. Survival time after intermediate dorsal onlay skin graft + urethroplasty subdivided according to preoperative urethrotomy execution. No urethrotomy: mean, 122.6 mo (95% confidence interval [95%CI], 99.6–145.6); urethrotomy: mean, 92.2 mo (95%CI, 68.7–115.6).

pathology, radiology, and surgery. Also, urologists are used to including different conditions, such as lichen sclerosus, failed hypospadias repair, and pelvic trauma, in the urethral stricture category [8]. Moreover, previous studies of the surgical outcomes of anterior urethral stricture disease have focused primarily on the technical aspects of the surgery; long-term results have rarely been reported [9–11]. Surgical treatment of urethral stricture diseases is a continually evolving process: The three different types of dorsal onlay skin graft bulbar urethroplasty we first described in 1996 [3,4] have changed over time [5,12,13]. From 1994 to 2000, penile skin was the preferred substitute material for urethroplasty and we employed it for this kind of repair. At present, we have left the use of skin graft because buccal mucosa has

become the most preferred substitute material in the treatment of urethral strictures: It is readily available in all patients and easily harvested from the inner cheek or lower lip, allowing for a concealed donor site scar and low oral morbidity [14]. Buccal mucosa is hairless and has a thick elastin-rich epithelium, which makes it tough yet easy to handle, and it has a thin and highly vascular lamina propria, which facilitates inosculation and imbibition [14]. Moreover, the use of buccal mucosa avoids the possible penile cosmetic complications caused by the use of genital skin. Prior to the use of buccal mucosa, genital skin was the preferred tissue-transferred material used for urethroplasty. Is buccal mucosa really superior to genital skin? Alsikafi et al [15], in an effort to answer whether buccal mucosa is really best, compared the outcome of 95 buccal mucosa urethroplasty and 24 penile skin graft urethroplasties. The overall success rate of penile skin urethroplasty was 84% (mean follow-up, 201 mo), whereas the success rate of buccal urethroplasty was 87% (mean follow-up, 48 mo). No statistically significant difference was found between the two groups. Gozzi et al [16] retrospectively evaluated the results of 194 patients with anterior or posterior urethral strictures. All patients were treated by dorsal onlay techniques with genital and extra-genital skin grafts; reported results were excellent with a 2% restricting rate and a mean follow-up of 31 mo. Finally it is necessary to emphasise that comparison of penile skin graft with other techniques such as buccal graft urethroplasty can only be speculative in the absence of any prospective randomised or case-control studies.

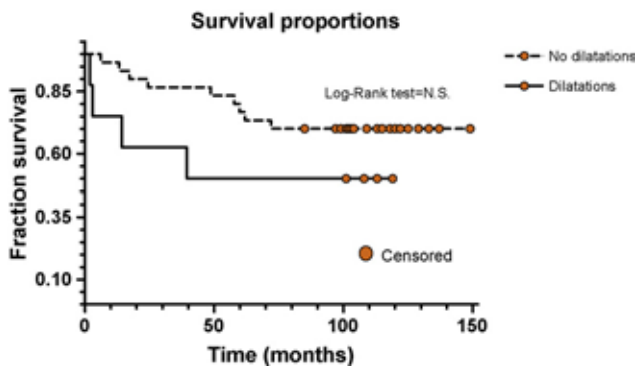


Fig. 3 – Accumulated survival rates. Survival time after intermediate dorsal onlay skin graft urethroplasty subdivided according to preoperative dilatation execution. No dilatation: mean, 116.3 mo (95% confidence interval [95%CI], 97.9–134.8); dilatation: mean, 66.85 mo (95%CI, 30.0–103.7).

We retrospectively reviewed the outcome of 72 patients who underwent bulbar dorsal onlay urethroplasty, 45 receiving penile skin grafts [7] and 27 buccal mucosa grafts [17]. Thirty-three of the 45 penile skin urethroplasties were successful (73%) and 12 (27%) were failures [7]. Twenty-three of the 27 buccal mucosal urethroplasty were successful (85%) and 4 (15%) were failures [17]. The skin graft urethroplasty showed a higher failure rate (27%) compared with the buccal mucosa graft (15%), with the penile skin grafts having a longer follow-up (mean, 71 mo) compared with the buccal mucosa grafts (mean, 42 mo) [7,17]. In conclusion, bulbar dorsal onlay urethroplasty showed better results when buccal mucosa is used as substitute material, although the use of skin appears to have a longer follow-up than buccal mucosa. Also, in adult patients who underwent penile complex urethroplasty following failed hypospadias repair, the use of buccal mucosa as substitute material for urethroplasty showed a higher success rate compared with genital skin [18]. In conclusion, the use of dorsal onlay skin graft urethroplasty may represent a valid option in patients with bulbar urethral strictures who are not ideal candidates for buccal mucosa harvesting.

In our experience, from 1998 to 2004, the success rate of dorsal onlay graft urethroplasty using penile skin as a substitute material decreased from 90% to 73%. At present, of the 38 patients who received dorsal onlay skin graft urethroplasty, 25 (65.8%) were considered successful and 13 (34.2%) failures, with a mean follow-up of 111 mo.

The analysis does not show a significant difference in terms of event-free survival time according to the length of stricture at the time of urethroplasty or a previous urethrotomy and dilatations. This lack of significance is probably due to the limited sample size and the resulting low statistical power. At Cox regression analysis, the number of urethrotomies performed before the urethroplasty represents instead a significant, though moderate, risk factor for failure, increasing the failure probability of 30% for each urethrotomy.

Andrich and collaborators [10] suggested that substitution urethroplasty steadily deteriorated with time so that, after 15 yr, more than half of the patients required evaluation for stricture recurrence. Nevertheless, this study included urethroplasties using different substitute materials (buccal mucosa, or genital or extragenital skin) and various techniques (penile or scrotal flaps, or various grafts), and stricture etiology was also variable resulting from a plethora of causes, such as pelvic trauma, inflammation, hypospadias failure, or lichen sclerosus. Moreover, stricture site and length were also

variable, including penile, bulbar, and panurethral strictures, and posterior defects. Evaluation of the deterioration rate of urethroplasty requires evaluation of the same surgical technique over time with the same substitute material used to repair urethral strictures in a similar location and with a similar etiology and length [19]. For this reason, we selected for our study a homogeneous series of 38 patients with bulbar urethral strictures, excluding patients with complex urethral diseases (lichen sclerosus and failed hypospadias repair); this approach may explain the different conclusion of our work. Furthermore, all patients were treated by a single surgeon (G.B.) who used an identical surgical procedure (dorsal onlay technique) with the same substitution material (penile skin). In our series, we found that deterioration of the success rate is linear in the first year following urethroplasty with a success rate of 71% after 5 yr, but afterwards the Kaplan-Meier curve is substantially flat.

5. Conclusions

We found that at long-term follow-up the success rate of dorsal onlay skin graft bulbar urethroplasty decreased primarily in the first 5 yr; afterward the success rate remained stable. The use of dorsal onlay skin graft urethroplasty remains a valid option in the armamentarium of the reconstructive urethral surgeon in patients who are not ideal candidates for buccal mucosa harvesting. It is mandatory to perform further long-term follow-ups with larger series of patients to better evaluate these results and our conclusions.

Conflicts of interest

No source of funding for the work was received.

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Editorial Comment on: Dorsal Onlay Skin Graft Bulbar Urethroplasty: Long-Term Follow-up

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The introduction of dorsal graft onlay for bulbar urethroplasty by Barbagli was a major technical advance and the present publication supports long-term durability of the procedure [1]. Selection of the most appropriate method of stricture management for an individual is difficult because many factors that may influence outcome over a prolonged period of time need to be considered. The evidence base to support such decision-making is restricted, relying predominantly on retrospective, single-institution, case series such as the present publication. The paper has general merit in “setting the standard” against which we can audit our own results and the findings will be of some help in counselling patients as to the likelihood and durability of success. The usefulness of more detailed analysis is restricted by the retrospective, uncontrolled study design, which increases uncertainty regarding the clinical significance of secondary findings derived from raw data. The

higher “cure” rate seen for previously untreated strictures could be considered supportive of the primary use of urethroplasty, but it remains uncertain how many men would have been cured by endoscopic means and whether recurrence is related to the underlying disease or choice of initial intervention. Uncertainty is also increased by contrasting results reported in previous publications [2,3]. The long-term durability of repair after 5 yr is another interesting finding, particularly because it appears unrelated to both previous treatment and stricture length, but again possible bias related to patient selection is of concern. These two issues would ideally be resolved using a prospective, randomized, multi-centre study design with long-term follow-up. The continued publication of single-centre case series confirms our interest in collecting outcome data; perhaps the time has come to initiate cooperative studies to generate robust results and reduce uncertainty in our counselling of men with stricture disease.

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