

Original Article

Evaluation of erectile function after urethral reconstruction: a prospective study

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Abstract

We conducted a prospective study of erectile dysfunction (ED) after urethral reconstructive surgery, using the 5-item International Index of Erectile Function (IIEF-5), the Sexual Life Quality Questionnaire (SLQQ) and the Quality of Life Questionnaire (QoLQ). Between January 2003 and July 2007, 125 male patients with urethral strictures underwent urethroplasty, and pre- and post-surgery erectile function was assessed using these three questionnaires. A formula to predict the probability of ED after urethroplasty was derived. At 3 months post-operatively, there was a significant decrease in IIEF-5 (16.57 ± 7.98) and SLQQ scores (28.71 ± 14.84) compared with pre-operative scores ($P < 0.05$). However, the IIEF-5 scores rebounded at 6 months post-operatively (17.22 ± 8.41). Logistical regression analysis showed that the location of the urethral stricture, the recurrence of strictures and the choice of surgical technique were predictive of the post-operative occurrence of ED. This study identified the clinical risk factors for ED after urethroplasty. Posterior urethral stricture and end-to-end anastomosis were found to have a strong relationship with erectile function. The logistical model derived in this study may be applied to clinical decision algorithms for patients with urethral strictures.

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Keywords: erectile dysfunction, urethroplasty, urethral stricture

1 Introduction

Urethral strictures represent a surgical challenge encountered in the practice of urology. Various surgical methods of reconstruction have been described, including direct visual internal urethrotomy, perineal urethral anastomosis and substitution urethroplasty.

If an inappropriate course of management is chosen, urosexual problems may appear.

Erectile function is a predictor of overall patient satisfaction after repair of urethral strictures [1]. Although male urethral reconstruction has become increasingly widely used, few long-term, patient-reported outcome data are available regarding erectile function after urethral operation. Previous studies have focused primarily on stricture recurrence and incontinence. However, erectile function is usually discussed as only a small part of broader reports of operative outcomes. Some reports have indicated that the age of the patient, sexual function before surgery, elapsed time after surgery, and stricture length and severity are likely to have direct influences on long-

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term erectile function after treatment [1, 6]. The aim of this study was to comprehensively evaluate, using self-administered questionnaires, erectile function in patients with urethral strictures undergoing repair.

2 Patients and methods

After obtaining approval from our hospital's review board, we identified 125 patients with urethral strictures who underwent urethral procedures in our hospital between January 2003 and July 2007. All patients were in stable sexual relationships. Patients with uncontrolled hypertension, diabetes mellitus and other major medical co-morbidities were excluded to avoid biases resulting from those diseases.

The original radiographs were reviewed in all cases to record details of the urethral defects. If the stricture was mainly located in the membranous and prostatic parts of the urethra, we defined it as a posterior urethral stricture. Strictures in other locations were considered anterior urethral strictures. Uroflowmetry was performed post-operatively. We defined stricture recurrence as urinary peak flow of less than 15 mL s⁻¹.

The 5-item International Index of Erectile Function (IIEF-5), Quality of Life Questionnaire (QoLQ) and Sexual Life Quality Questionnaire (SLQQ) were self-administered by the study participants. Most patients in our study were free of catheters during the 3 months after surgery. In an attempt to more comprehensively assess erectile function and satisfaction after urethroplasty, we evaluated patients' responses before the intervention as well as 3 and 6 months post-operatively. After discharge, all patients were followed up by mail or telephone. Non-responding patients were contacted again 2 weeks later. Abnormal erectile status was defined as an IIEF-5 score of < 21 [2]. Within the SLQQ questionnaire, 11 items addressed sexual quality of life (QoL). Ten items addressed specific aspects of sexual QoL, including frequency of lovemaking, duration of lovemaking, ease of insertion, ease of achieving orgasm, ease of initiating lovemaking, pleasure of anticipation, carefree feelings, pleasure of orgasm, pleasure of overall experience and partner's pleasure of experience. The eleventh question asked respondents to provide an overall assessment of sexual QoL, and so we did not include the last item. The scoring of the nine-point instrument response ranged from 0 to 8. Anchors were provided, with 0 indicating that satisfaction with any particular aspect of one's sexual

life was 'much worse', 4 indicating that it was the 'same', and 8 indicating that it was 'much better' than before developing impotence [3].

The survey data were tabulated and are expressed as mean ± SD. We used the paired *t*-test and chi-squared (χ^2) test to compare pre- and post-operative data. In particular, all variables were entered into the logistical regression analysis in a backward stepwise manner. Continuous variables were transformed into categorical variables by grouping them. According to the length of urethral strictures, we classified the patients into four groups (< 2, 2–5, 6–10 and > 10 cm).

All statistical analyses were performed using SAS software (SAS Institute, Cary, NC, USA). *P* < 0.05 were considered statistically significant.

3 Results

The demographic characteristics of the responders are summarized in Tables 1 and 2. Each patient had previous open urethral reconstruction from one to nine times (mean 1.7) in our study. These patients were followed in the post-operative period for 6–60 months (mean 27.3 ± 12.7 months). All patients in our study had hormone levels within normal ranges

Table 1. Characteristics of 125 male patients with urethral stricture.

| | <i>n</i> (%) |
|--|--------------|
| Age (years) | |
| < 40 | 55 (44.0) |
| 40–50 | 38 (30.4) |
| 50–60 | 21 (16.8) |
| > 60 | 11 (8.8) |
| Operation | |
| Dorsal patch tissue substitution | 55 (44.0) |
| Bulboprostatic anastomotic urethroplasty | 70 (56.0) |

Table 2. Details of urethral stricture in 125 study patients.

| Stricture length (cm) | Anterior stricture | Posterior stricture |
|-----------------------|--------------------|---------------------|
| | <i>n</i> (%) | <i>n</i> (%) |
| < 2 | 6 (4.8) | 3 (2.4) |
| 2–5 | 33 (26.4) | 40 (32) |
| 6–10 | 15 (12.0) | 4 (3.2) |
| > 10 | 17 (13.6) | 7 (5.6) |

Table 3. Comparison of Q_{max} , QoLQ, IIEF-5 and SLQQ scores before and after urethroplasty.

| | Before surgery | 3 months after surgery | 6 months after surgery |
|---------------------------------|----------------|----------------------------|---------------------------|
| Q_{max} (mL s ⁻¹) | 5.21 ± 3.56 | 25.17 ± 7.91 ^a | 27.32 ± 8.11 |
| QoL score | 6.31 ± 2.18 | 1.93 ± 1.72 ^a | 1.64 ± 1.58 |
| IIEF-5 score | 16.57 ± 7.98 | 11.52 ± 6.43 ^a | 17.22 ± 8.41 ^b |
| SLQQ score | 28.71 ± 14.84 | 22.71 ± 13.53 ^a | 26.72 ± 15.19 |

Abbreviations: IIEF-5, 5-item International Index of Erectile Function; QoLQ, Quality of Life Questionnaire; SLQQ, Sexual Life Quality Questionnaire.

^aComparison of pre-operative and 3 months post-operative conditions ($P < 0.05$).

^bComparison of 3 and 6 months post-operative conditions ($P < 0.05$).

Table 4. Comparison of pre- and post-operative 5-item IIEF-5 and SLQQ scores in different age brackets.

| Age (years) | IIEF-5 scores | | | SLQQ scores | | |
|-------------|----------------|---------------------------|---------------------------|----------------|----------------------------|------------------------|
| | Before surgery | 3 months after surgery | 6 months after surgery | Before surgery | 3 months after surgery | 6 months after surgery |
| < 40 | 18.03 ± 9.32 | 14.59 ± 7.11 ^b | 17.54 ± 4.67 ^a | 27.86 ± 12.65 | 22.17 ± 12.49 ^b | 24.68 ± 6.69 |
| 40–50 | 20.12 ± 6.56 | 13.21 ± 8.92 ^b | 15.71 ± 5.53 | 27.12 ± 14.73 | 20.16 ± 11.36 ^b | 21.85 ± 10.75 |
| 50–60 | 14.23 ± 7.22 | 11.93 ± 8.51 | 12.16 ± 7.48 | 23.44 ± 14.61 | 21.65 ± 11.82 | 20.67 ± 10.25 |
| > 60 | 17.59 ± 7.47 | 13.12 ± 7.46 | 13.59 ± 8.15 | 28.63 ± 12.89 | 21.26 ± 13.06 | 20.25 ± 13.04 |

Abbreviations: IIEF-5, 5-item International Index of Erectile Function; SLQQ, Sexual Life Quality Questionnaire.

^aComparison of 3 months and 6 months post-operative conditions ($P < 0.05$).

^bComparison of pre-operative and 3 months post-operative conditions ($P < 0.05$).

(testosterone [T], 543.12 ± 84.22 ng mL⁻¹; estrogen [E2], 70.30 ± 32.12 pg mL⁻¹; luteinizing hormone [LH], 5.83 ± 1.23 mIU L⁻¹; follicle-stimulating hormone [FSH], 5.23 ± 2.72 mIU L⁻¹).

The QoL and mean peak flow rate were significantly improved at 3 months post-operatively ($P < 0.05$). However, at the 3-month follow-up visit, there were statistically significant decreases in IIEF-5 and SLQQ scores ($P < 0.05$). A statistically significant ($P < 0.05$) rebound in IIEF-5 scores was observed at 6 months post-operatively (Table 3).

In all, 49 (39.2%) patients were diagnosed with erectile dysfunction (ED) based on IIEF-5 criteria before surgery. In the post-operative period, the number of patients with ED increased from 49 to 87 (69.6%). Of the 49 patients who were impotent pre-operatively, five became potent 6 months after the procedure. However, the quality of erection in the 76 men who were potent before surgery was rated as 'fair to poor' in 33 (26.4%) patients at the end of the 6-month follow-up period.

We then sought to identify the characteristics relating to impaired erectile function. At 3 months after surgery, there was a significant decline in the

mean IIEF-5 and SLQQ scores ($P < 0.05$) in patients younger than 50 years. Patients with posterior urethral strictures had significantly lower overall scores in the post-operative period than those with anterior strictures. Statistical differences before and after urethroplasty in IIEF-5 and SLQQ scores could also be found in patients whose length of urethral strictures ranged from 2 to 5 cm. End-to-end anastomosis was associated with lower IIEF-5 and SLQQ scores. However, 6 months after surgery, a significant rebound in IIEF-5 and SLQQ scores was observed only in men younger than 40 years (Tables 4–7).

We considered four factors that may be associated with ED: post-surgical stricture recurrence, urethral stricture length, location of the stricture and surgical procedure. Of these four variables, three showed a strong relationship to ED after analysis and were retained in the logistical regression model (Table 8). We sorted these variables according to odds ratio (OR). The linear predictor equation in the model was $Z = -0.3710 + 3.0123X_1 - 1.0543X_2 - 2.2642X_3$ (Z , possibility of ED; X_1 , location of urethral problem; X_2 , method of procedure; X_3 , status of recurrence).

Table 5. Comparison of pre- and post-operative IIEF-5 and SLQQ scores for anterior and posterior urethral strictures.

| | IIEF-5 scores | | | SLQQ scores | | |
|------------------------------|----------------|------------------------|------------------------|----------------|------------------------|------------------------|
| | Before surgery | 3 months after surgery | 6 months after surgery | Before surgery | 3 months after surgery | 6 months after surgery |
| Anterior urethral stricture | 17.34 ± 7.56 | 14.23 ± 8.66 | 17.09 ± 7.79 | 26.07 ± 12.23 | 22.58 ± 12.83 | 21.16 ± 12.81 |
| Posterior urethral stricture | 17.05 ± 9.47 | 9.37 ± 7.38* | 11.53 ± 8.27 | 26.38 ± 12.19 | 14.94 ± 11.25* | 17.03 ± 11.18 |

Abbreviation: IIEF-5, 5-item International Index of Erectile Function.

**P* < 0.05, compared with pre-operative conditions.

Table 6. Comparison of pre- and post-operative IIEF-5 and SLQQ scores by stricture length.

| Age (years) | IIEF-5 scores | | | SLQQ scores | | |
|-------------|----------------|------------------------|------------------------|----------------|------------------------|------------------------|
| | Before surgery | 3 months after surgery | 6 months after surgery | Before surgery | 3 months after surgery | 6 months after surgery |
| < 2 | 21.23 ± 11.78 | 18.23 ± 7.23 | 18.11 ± 4.83 | 26.19 ± 12.71 | 22.74 ± 11.49 | 23.69 ± 10.43 |
| 2–5 | 18.54 ± 7.21 | 14.67 ± 8.71* | 15.49 ± 7.35 | 26.44 ± 12.21 | 21.24 ± 11.93* | 22.17 ± 10.29 |
| 5–10 | 16.21 ± 7.94 | 15.83 ± 7.68 | 16.12 ± 8.43 | 23.72 ± 13.23 | 21.22 ± 11.83 | 20.15 ± 12.73 |
| > 10 | 18.04 ± 9.22 | 16.63 ± 7.43 | 17.15 ± 8.21 | 24.61 ± 13.55 | 21.76 ± 12.45 | 22.47 ± 10.92 |

Abbreviations: IIEF-5, 5-item International Index of Erectile Function; SLQQ, Sexual Life Quality Questionnaire.

**P* < 0.05, compared with pre-operative conditions.

Table 7. Comparison of pre- and post-operative IIEF-5 and SLQQ scores by two types of procedure before, 3 months after and 6 months after surgery.

| | IIEF-5 scores | | | SLQQ scores | | |
|---|----------------|------------------------|------------------------|----------------|------------------------|------------------------|
| | Before surgery | 3 months after surgery | 6 months after surgery | Before surgery | 3 months after surgery | 6 months after surgery |
| Bulboprosthetic anastomotic urethroplasty | 19.31 ± 8.08 | 14.31 ± 8.73* | 15.59 ± 6.88 | 27.09 ± 11.58 | 21.60 ± 10.11* | 22.93 ± 12.72 |
| Dorsal patch tissue substitution | 16.77 ± 9.50 | 13.92 ± 8.12 | 14.33 ± 7.54 | 22.41 ± 11.67 | 20.51 ± 9.39 | 21.49 ± 7.91 |

Abbreviations: IIEF-5, 5-item International Index of Erectile Function; SLQQ, Sexual Life Quality Questionnaire.

**P* < 0.05, compared with pre-operative conditions.

Table 8. Multivariate logistical regression model.

| Variable | B | SE | WALD | <i>P</i> -value | OR |
|-----------------------|---------|---------|---------|-----------------|--------|
| Location of stricture | 3.0123 | 0.8300 | 18.7458 | 0.0001 | 20.334 |
| Method of procedure | -1.1884 | -0.7745 | 15.5158 | 0.0001 | 0.305 |
| Recurrence | -2.2642 | -0.5082 | 9.3530 | 0.0022 | 0.104 |
| Constant | -5.7810 | -1.0032 | 12.8931 | 0.00 | 0.00 |

Abbreviations: B, parameter estimate; OR, odds ratio; SE, Standard Error; WALD, Wald Chi-Square.

Location of stricture: 1, anterior urethral stricture; 2, posterior urethral stricture. Methods of procedure: 1, end-to-end anastomosis; 2, dorsal patch tissue substitution. Recurrence: 0, no recurrence, 1, recurrence.

4 Discussion

In recent years, various surgical techniques have been used to perform one-stage repair of urethral strictures. However, the early and late complications of urethral reconstruction have not been fully described in the literature. Several studies have commented on the incidence of ED. Current data indicate that the incidence of impotence after urethral reconstruction ranges from 16.2% to 72% [12]. To identify risk factors for male erectile function after reconstructive surgery, we used the IIEF-5 and SLQQ questionnaires.

A recent study of 200 patients with urethral strictures

indicated that post-operative impotence of duration less than 3 months occurred in 53% of patients who underwent anastomosis, compared with 33% who underwent patch repair. However, when observed over longer follow-up intervals, these rates dramatically decreased to 5% and 0.9%, respectively [4]. Corriere [5] evaluated erectile function in 60 patients with delayed repairs of complete posterior urethral ruptures. Of the patients who were potent pre-operatively, 29 (48%) complained of ED post-operatively and 9 regained potency at 1 year. This report is in agreement with our own findings that erectile function lost in the immediate post-operative period may be regained at later time intervals. Recovery of erectile function may be attributed to increases in penile sensation, the gradual subsiding of edema and inflammation at the surgical site and psychosocial factors.

As the incidence of complete impotence is reported to be 5% at age 40 and 15% at age 70 [6], we first considered whether age is a confounding variable in post-operative ED. In our study, 74.4% of all patients were less than 50 years of age, suggesting that age was not a confounding variable. However, we found that patients younger than 40 years could regain erectile function 6 months after surgery. This observation indicated that age may be related to the recovery of erectile function.

Lue *et al.* [7] demonstrated by cadaver dissection that most of the cavernous nerve fibers that supply the corpus spongiosum do not pass through the tunica albuginea. These nerves occupy the 1 and 11 o'clock positions at the level of convergence of the crura of the corpora cavernosa. In addition, the corpus spongiosum is highly elastic and can be readily re-anastomosed after mobilization and stricture excision, even in cases of long strictures [8]. Taken together, these findings suggest that anterior urethral reconstruction should not predispose patients to long-term ED. Eltahawy *et al.* [9] conducted a longitudinal study of 260 patients undergoing anterior urethral reconstruction. ED occurred in only six (2.3%) patients, all of whom had good erectile function pre-operatively. By comparison, patients with posterior urethral strictures usually had more scar tissue, which makes it more difficult for the surgeon to mobilize the corpus spongiosum. Consequently, the neurovascular bundle is more easily damaged during surgery, which increases the incidence of ED. We demonstrated that the IIEF-5 and SLQQ scores decreased more significantly after posterior,

compared with anterior, urethral reconstruction. These findings may be explained by the observations described above. In addition, we suspect that the inadequate excision of scar tissue at the site of urethral stricture may contribute to persistent ED.

In recent reports, the incidence of impotence after urethral reconstruction using various flaps or grafts ranged from 0% to 3% [10, 11]. No statistical differences in IIEF-5 and SLQQ scores were found before and after this procedure in our group. In this procedure, the number of patients with impotence according to the IIEF-5 criteria was similar to the number of those without impotence. We did not expect any change in erectile function in those who underwent the end-to-end anastomosis, as Koraitim [13] suggest that impotence is usually related to the original trauma and rarely (2%) to urethroplasty itself. Furthermore, no patient reported a decline in erectile function after end-to-end anastomosis in a study by Barbagli *et al.* [14]. However, we found a significant reduction in IIEF-5 scores after anastomosis in our group. As most operations were conducted by the same surgeon, we believe that the bias from the urologist was minimized, and therefore that the anastomosis procedure negatively affected the patients' erectile function. In addition, erectile function was significantly decreased in patients whose length of urethral stricture ranged from 2 to 5 cm after the procedure. It should be explained by the fact that the anastomosis procedure was often chosen for those patients.

The data indicate that ED occurs after urethral reconstruction for the repair of urethral strictures. We have identified the risk factors for ED, including, but not limited to, the location of the stricture and the choice of surgical technique. The posterior urethral stricture and end-to-end anastomosis procedures have a particularly strong association with erectile function. These results may be relevant to the medical and surgical management of patients with urethral strictures.

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