Assessment of the Male Urethral Reconstruction Learning Curve

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OBJECTIVE To evaluate the urethroplasty learning curve. Published success rates of urethral reconstruction for urethral stricture disease are high even though these procedures can be technically demanding. It is likely that success rates improve with time although a learning curve for urethral reconstruction has never been established.

MATERIALS AND METHODS We retrospectively reviewed anterior urethroplasties from a prospectively maintained multiinstitutional database. Success was analyzed at the 18-month mark in all patients and defined as freedom from secondary operation for stricture recurrence. A multivariate logistic regression was performed for outcomes vs time from fellowship and case number.

RESULTS A total of 613 consecutive cases from 6 surgeons were analyzed, with a functional success rate of 87.3%. The success rate for bulbar urethroplasties was higher than that for penile urethroplasties (88.2% vs 78.3%, $P = .0116$). The success rate of anastomotic repairs was higher than that for substitution repairs (95.0% vs 82.4%, $P = .0001$). There was a statistically significant trend toward improved outcomes with increasing number of cases ($P = .0422$), which was most pronounced with bulbar repairs. There was no statistical improvement in penile repairs over time. The case number to reach proficiency (>90% success) was approximately 100 cases for all types of reconstruction and 70 cases for bulbar urethroplasty. There were statistical differences in success rates among the participating surgeons ($P = .0014$). Complications decreased with time ($P = .0053$).

CONCLUSION This study shows that success rates of anterior urethral reconstruction improve significantly with surgeon experience. Proficiency occurs after approximately 100 cases. UROLOGY 89: 137–143, 2016. Published by Elsevier Inc.

Urethroplasty is considered the gold standard treatment for urethral stricture disease with procedure- and location-dependent success rates ranging from 75% to 99%.[1-3] Despite the high success rates, urethroplasty is a technically demanding operation in which no single type of urethroplasty can be utilized for all types of strictures. As with other complex procedures, both technical and clinical expertise are required before high success rates can be achieved, implying that a significant learning curve likely exists.

Overall utilization of urethroplasty for urethral stricture disease in the United States is low, but with an increase in studies showing both the clinical and cost-effective superiority of urethroplasty as compared with urethrotomy or dilation, the rates of urethroplasty are expected to rise.[4-9] An additional factor in utilization rates will likely come from the expanded number of reconstructive urologic fellowship programs currently available to graduating residents, which will increase the exposure of the majority of recently trained urologists to urethral reconstruction.[10]

The purpose of this study was to analyze the early surgical outcomes from a group of recently trained reconstructive urologic fellows in order to generate a learning curve and to provide an estimate of the number of cases needed to reach surgical proficiency. We hypothesized that urethroplasty outcomes would improve with the number of urethroplasty cases performed over time.

MATERIALS AND METHODS

Study Population

We examined surgical success in consecutive patients who underwent anterior urethroplasty by 6 surgeons who are members of the Trauma and Urologic Reconstruction Network of Surgeons (TURNS). Patients with at least 18 months of objective postoperative follow-up were included. We reviewed the surgical records from a prospective (from years 2009 to present) and

Financial Disclosure: *The authors declare that they have no relevant financial interests.*

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Submitted: August 18, 2015, accepted (with revisions): November 3, 2015

retrospective (from years prior to 2009) database for surgical outcomes after anterior urethroplasty with cases starting from immediately after fellowship training to present. Institutional review board approval was obtained for this study at each site. All patients who underwent urethroplasty after June of 2009 were enrolled in a TURNS-specific follow-up protocol described previously.[11]

Primary and Secondary Outcomes

The primary outcome was functional stricture recurrence which was defined as recurrence of the urethral stricture at the site of the previous repair that required any secondary operation, including formal urethral dilation, urethrotomy, or repeat urethroplasty within the first 18 months after their initial procedure. Recurrences after 18 months were not considered. Follow-up time was calculated as the elapsed time from surgery to date of last contact with patient in which objective (cystoscopy, uroflowmetry) or subjective (questionnaire) data were recorded.

Secondary outcomes such as operative blood loss and the presence of postoperative complications were analyzed by dichotomous yes or no for presence of any complication. Complications that were prospectively recorded included deep vein thrombosis, myocardial infarction, pulmonary embolus, postoperative hematoma, wound infection (defined as need for new antibiotic treatment), urinary tract infection (symptomatic including epididymo-orchitis and prostatitis), postoperative urethracutaneous fistula, and lower and upper extremity neurological complaints.

Statistical Analysis

Surgeon-specific and overall group success rates were analyzed over time by groups of 10 cases. Trends in success rates for all cases and then by subgroup, including stricture location (penile, bulbar) and repair type (excisional, substitution), were analyzed using a Cochran-Armitage Trend Test (SAS version 9.3; Cary, NC). We evaluated differences in overall recurrence rates between surgeons with a chi-squared test. We compared success rates between surgery type and stricture location using a *t*-test. Finally, we used logistic regression to evaluate the individual effects of both time from fellowship (in months) and number of total cases performed since fellowship (by 10 cases) on stricture recurrence rates and postoperative complications. For all tests, a P value <.05 determined statistical significance.

RESULTS

Overall Outcomes

A total of 613 anterior urethroplasties were analyzed from the 6 study surgeons. The total cases analyzed per surgeon averaged 102 (range 42-200). The average number of cases performed per surgeon per year averaged 21.8 (range 14-53), which increased significantly with years in practice (P = .0036). The average time from fellowship of case performance was 2.2 ± 1.2 years (range 0-5.2 years). Average stricture length did not differ significantly over time (all P values for trend were >0.05) by location (bulbar 2.8 ± 1.2 cm; penile 4.2 ± 2.5) or by type of repair (excisional 1.4 ± 1.2 cm; buccal 3.2 ± 2.8).

The overall functional success rate was 87.3% with individual surgeon success rates ranging between 80.3% and 92.7%. The success for bulbar repairs was significantly higher at 88.2% (range 83.9-98.6%) than for penile repairs at 78.3% (range 61.5-90.9%) (P = .0116). The success for anastomotic repairs was significantly higher at 95.0% (range 88.2-100%) than for substitution repairs at 82.4% (range 76.2-96.5%) (P = .0001). Case mix (ie percentage of anastomotic vs substitution) did not change with years in practice. Controlling for stricture location, years out of fellowship, and repair type, success rates between surgeons were statistically different (P = .0014). The overall complication rate was 15% (n = 74), the most common complication being urinary tract infection (4%).

Success Rates Over Time

Overall success rates improved significantly with time (P = .0422 for trend), with improvements being most pronounced with bulbar urethroplasties (Figs. 1–3). Overall success rates for penile repairs did not appear to improve with time (Fig. 2).

Defining proficiency as a success rate of >90%, this group of surgeons averaged approximately 100 cases before obtaining proficiency for all types of urethroplasty (Fig. 1). When only bulbar urethroplasties were analyzed, it required approximately 70 cases. Proficiency for excisional repairs occurred immediately after fellowship (ie >90% success was achieved within the first 10 cases) although continued to improve with time. An overall success rate of >90% was never achieved for penile urethroplasties (Fig. 2) during the study period.

Logistic regression revealed significant decreases in the odds of recurrence with both time from fellowship and in the number of cases performed after fellowship (Table 1). Notably, there was a 4% decrease (odds ratio [OR] 0.96) in the odds of secondary procedures for bulbar cases for every month out of fellowship and an 18% decrease for every 10 bulbar cases performed. For nonexcisional cases (ie buccal graft, penile flap in all locations), the odds of secondary procedures decreased by 18% (OR 0.82) for every 10 cases performed after completion of fellowship.

The odds of complications decreased by 3% (OR 0.97) and 4% (OR 0.96) for every month out of fellowship for bulbar and penile cases, respectively. Blood loss did not appear to be affected by time from fellowship or case number.

DISCUSSION

The purpose of this study was to analyze the outcomes of urethroplasty among academic urologists who recently completed a reconstructive urologic fellowship. In doing so, we generated a learning curve, which revealed improved success rates with an increase in case numbers and a decrease in complication rates with time out from fellowship. We arbitrarily defined proficiency as a functional success rate of >90% (an often quoted success rate in clinical practice) and estimated that the average number of anterior urethroplasties needed to reach proficiency was approximately 100 cases after a reconstructive urologic fellowship. To our knowledge, this is the first study to address the learning curve for urethral reconstruction.