

Effects of Anastomotic Posterior Urethroplasty (Simple or Complex) on Erectile Function: a Prospective Study

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Purpose: Although improvements in urological function have been less challenged, concern about andrological problems following urethral stricture surgeries has been growing in recent years. The aim of this study is to evaluate the role of the anastomotic urethroplasty itself on erectile function in patients with posterior urethral injuries.

Materials and Methods: In this prospective cohort study, patients with urethral strictures referring to Tajrish Hospital during October 2013 to August 2016 for anastomotic urethroplasty, were included. All subjects underwent radiologic studies along with rigid and flexible cystoscopy before surgery. Erectile function was evaluated before surgery (twice, addressing pre-traumatic and pre-operational conditions) and after surgery (3 and 6 months post-operatively) via IIEF-5 erectile function questionnaire and color Doppler ultrasound assessment of penile vasculature.

Results: A total of 65 patients with an average age of 30.6 ± 6.1 years were included. A significant decline was observed in erectile function of patients after the injury based on IIEF-5 questionnaire filled twice separately addressing patient conditions before and after trauma (mean IIEF score 23.15 ± 0.93 to 13.45 ± 5.43 , $P = .001$). There was also a significant difference in erectile function of subjects with pelvic fractures compared to those without pelvic fractures (10.43 ± 3.78 vs. 18.96 ± 3.18 , $P = .001$). Univariate and multivariate analyses showed that urethroplasty itself does not significantly affect erectile function in patients according to penile color Doppler ultrasonography (peak systolic velocity at cavernosal arteries before and after surgery: right 26.87 ± 6.93 vs 26.16 ± 6.53 respectively and left 27.23 ± 5.21 vs 26.52 ± 4.38 respectively) and IIEF-5 erectile function questionnaire (13.12 ± 5.38 vs. 13.54 ± 5.44 ; $P = .26$).

Conclusion: The results of this study showed that urethroplasty does not significantly affect erectile function in patients with urethral strictures. The marginal results showing a negatively affected erectile function in patients with complex strictures may be attributed to a real impact of the surgery in this subgroup or lower number of these cases in our study.

Keywords: erectile dysfunction; reconstructive surgical procedures; urethral stricture; urethroplasty; urethral transection.

INTRODUCTION

Urethral stricture is among the complex urological problems that has always been a challenge for urologists. Treatments for urethral strictures include various reconstruction techniques, the most suitable of which can be selected according to the length and site of stricture, extent of spongiositis and the surgeon's skills⁽¹⁾. It is undeniable that urethroplasty techniques are associated with high success rates, if performed properly. Sufficient evidence exists on the results of anastomotic and substitutional techniques. By thorough assessment of objective factors such as flow rate, different authors have reported success rates of more than 80-90% for bulbar⁽²⁾, penile⁽³⁾ and even posterior urethra⁽⁴⁾. Although urethral injuries are not prevalent, but their incidence has increased due to the rising number of motor-vehicle accidents in recent years. Most urethral injuries are due to pelvic fractures associated with blunt abdominal traumas or straddle injuries⁽⁵⁾. In injuries to the posterior urethra particularly in complicated cases, surgeon's accessibility is limited due to the specific

anatomy of this region and so potential complications after surgery such as urinary incontinence and erectile dysfunction (ED) are more prevalent⁽⁶⁾. Main branches of common penile artery in posterior urethroplasty and its distal branches in anterior urethroplasty are prone to surgical injuries. Moreover, the neurovascular bundles approximate to the posterior membranous urethra are susceptible to neurogenic injuries as well⁽⁷⁾. The psychological stress caused by urethral stricture and its surgical interventions along with the inflammation and edema after surgery could also contribute to development of ED. As mentioned, ED is the result of a multifactorial process and its components can be affected by urethroplasty surgeries.

Although, increasing attention has been drawn to different andrological aspects of urethral stricture surgeries, but the relation between urethroplasty and erectile function is still a matter of discussion. Lack of sufficient evidence, inclusion of heterogeneous sample populations and different methodologies and statistical analyses have led to incongruent results on this matter⁽⁸⁾. Accordingly, we aimed to assess the effects of urethroplasty

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Table 1. The frequency of pelvic fracture, previous pelvic surgery, previous endoscopic interventions and failed urethroplasty based on the location and length of the stricture.

Characteristics	History of Pelvic fracture N (%)	History of previous endoscopic manipulation N(%)	History of failed urethroplasty N (%)	History of pelvic surgery N (%)
Bulbar Urethra (14 patients)	5 (35.7)	8 (57.1)	3 (21.4)	2 (14.2)
Membranous Urethra (3 patients)	1 (33.3)	2 (66.7)	0 (0.0)	0 (0.0)
Bulbo-Membranous Urethra (48 patients)	36 (75)	10 (20.8)	15 (31.2)	15 (31.5)
Stricture length \leq 2 (6 patients)	2 (33.3)	3 (50.0)	0 (0.0)	2 (33.3)
2 < Stricture length \leq 4 (32 patients)	21 (65.6)	12 (37.5)	4 (12.5)	6 (18.7)
4 < Stricture length \leq 6 (19 patients)	14 (73.7)	5 (26.3)	9 (47.4)	7 (36.8)
Stricture length > 6 (8 patients)	5 (62.5)	0 (0.0)	5 (62.5)	2 (25.0)

on erectile function of patients with traumatic posterior urethral strictures referring to Tajrish Hospital, which is the only specialized center for urological reconstruction interventions in Iran.

MATERIALS AND METHODS

Study population

In this prospective cohort study, 65 patients with urethral strictures referring to Tajrish Hospital during October 2013 to August 2016 were included. All subjects with different traumatic causes of urethral strictures had suprapubic catheters in place, more than 6 months had passed from their causative trauma and they were candidates for anastomotic urethroplasty. None of them had erectile dysfunction prior to the trauma, they were all married and capable of having intercourse.

Exclusion criteria

Subjects who were found to have a psychological erectile dysfunction according to Nocturnal Penile Tumescence test (NPT), any hormonal problems in their laboratory evaluations or any uncontrolled systemic diseases such as diabetes, hypertension, dyslipidemia, thyroid dysfunction and etc. and patients with a history of using any medicine that could affect erectile function such as anti-depressants or psychoactive drugs were excluded.

Evaluations

Patients underwent a thorough evaluation including a complete medical history taking, physical examination and laboratory assessments. All subjects also underwent Retrograde Urethrogram along with Voiding Cysto-Urethrogram, and then simultaneous rigid and flexible cystoscopy via the anterior urethra and cystostomy tract, respectively. Bladder neck, posterior urethra, anterior urethra, length and location of the stricture were assessed and patients eligible for anastomotic urethroplasty were selected. The anatomical site of defect was described as bulbar (proximal bulbar, Adjacent to the membranous area), bulbo-membranous and membranous urethra. The stricture was calculated by a simple ruler considering the minimization percentage of the digitally printed graph.

Table 2. Frequency of erectile dysfunction according to IIEF-5 questionnaire, before and 6 months after urethroplasty.

ED classification	Before urethroplasty N (%)	6 months After urethroplasty N (%)
No ED	10 (15.4)	11 (17.0)
Mild ED	12 (18.5)	7 (9.2)
Mild to Moderate ED	9 (13.8)	14 (24.6)
Moderate ED	19 (29.2)	15 (21.5)
Severe ED	15 (23.1)	18 (27.7)
Total	65 (100.0)	65 (100.0)

Medical history included information on previous pelvic fractures, previous pelvic surgeries, previous endoscopic interventions and failed urethroplasties. Complex cases were defined as the patients with history of previous urethral surgery and stricture length more than 6 centimeters.

Color Doppler ultrasound assessment of the penile vasculature was performed by a radiologist before and 6 months after the surgery by injection of 30 mg Papaverine. Peak Systolic Velocity (PSV) and End-Diastolic Velocity (EDV) were calculated and PSV < 25 cm/s and EDV > 5 cm/s were considered as arterial obstruction and venous insufficiency, respectively.

Erectile function was evaluated via a translated and culturally adapted Iranian version of the International Index of Erectile Function (IIEF - 5) questionnaire, validated by Pakpour et al. in 2014⁽⁹⁾. For each patient the questionnaire was filled twice on the day before surgery based on their sexual activity condition before and after trauma. The results were categorized into 5 groups based on the scores from this questionnaire: scores of 5 - 7 as severe dysfunction, 8 - 11 as moderate dysfunction, 12 - 16 as mild to moderate dysfunction, 17 - 21 as mild dysfunction and 22 - 25 as normal⁽¹⁰⁾. The IIEF scores of all patients before trauma were 22 - 25 (normal). Further assessments were performed 3 and 6 months after the surgery. Anastomotic urethroplasty was done by a single surgeon in all subjects.

Procedures

Technically in our center, posterior urethral end to end anastomosis includes a perineal approach to the urethra through meticulous dissection of the urethra, proper exposure of the area, finding the distal end of the stricture site by a Nelaton catheter and the proximal end of the stricture by flexible cystoscopy. Then we transect the urethra on fibrotic stricture area and resect the abnormal tissue until access to the healthy urethral tissue containing no fibrotic scar tissue. Then spatulation and anastomosis is performed using six 3-0 vicryl sutures. In longer strictures crural separation and partial (rarely total) pubectomy may be necessary to achieve a tension-free anastomosis.

Statistical analysis: SPSS version 20.0 software was

Table 3. Results of linear regression analysis on the variables affecting erectile function after urethroplasty

Variable	Linear Regression	P value
Site of urethral stricture	-1.38 \pm 2.07	0.50
Age	-0.07 \pm 0.05	0.15
Length of urethral stricture	0.57 \pm 1.75	0.74
History of pelvic fracture	0.41 \pm 0.74	0.57
History of pelvic surgery	-0.37 \pm 0.81	0.64
History of endoscopic manipulation	0.22 \pm 0.67	0.74
History of failed urethroplasty	0.02 \pm 0.84	0.97

Table 4. EDV and PSV of the right and left cavernosal arteries, before and 6 months after urethroplasty.

Variable	Before urethroplasty	6 months After urethroplasty	P value
Right PSV (Mean ± Standard Deviation)	26.87 ± 6.93	26.16 ± 6.53	0.15
Left PSV (Mean ± Standard Deviation)	27.23 ± 5.21	26.52 ± 4.38	0.16
Right EDV (Mean ± Standard Deviation)	3.95 ± 2.23	4.14 ± 2.22	0.26
Left EDV (Mean ± Standard Deviation)	4.53 ± 1.84	4.60 ± 1.81	0.72

used for statistical analysis (IBM corp., Chicago, IL, USA). Data were presented as mean and standard deviation for quantitative variables and as frequency and percentage for qualitative variables. Chi-square test and Fisher's Exact test were used for comparison of qualitative variables while quantitative variables were analyzed by Paired Samples *T* - Test and Independent Samples *T* - test. Linear regression analysis was also used to assess simultaneous effects of variables. A *P* value of less than 0.05 was considered as statistically significant in all analyses.

The methods of the study were assessed and confirmed by the Institutional Review Board of Tajrish Hospital and the Ethics committee of Shahid Beheshti University of Medical Sciences. The aims and methods of the survey and its importance was thoroughly explained to the patients and an informed written consent was obtained from the subjects willing to participate. The study was conducted in accordance to the principles of Helsinki's Declaration. Gathered information was considered confidential and used anonymously throughout the survey.

RESULTS

A total of 65 patients with an average age of 30.6 ± 6.1 years were included. The most prevalent cause of urethral stricture was motor-vehicle accident reported in 48 (73.8%) patients followed by fall from heights observed in 9 subjects (14%). The remaining 8 patients (12.2%) had membranous urethral strictures due to occupational trauma (6 patients) or traumatic catheterization (2 patients). Comprising the majority of patients for each variable, 32 subjects (49.2%) were aged between 20 to 30 years old, 48 (73.8%) had stricture at the bulbomembranous urethra and 32 patients (49.2%) had strictures measuring 2 - 4 cm in length. A total of 42 subjects (64.6%) had pelvic fractures, of which 20 (47.6%) were found to have displacement of pubis symphysis. **Table 1** presents the frequency of pelvic fracture, previous pelvic surgery, previous endoscopic interventions and failed urethroplasty in the sample population based on the location and length of their stricture.

A significant decline was observed in erectile function of patients based on IIEF - 5 questionnaire after the incident (23.15 ± 0.93 to 13.45 ± 5.43 ; $P = .001$). **Table 2** presents the correlation between erectile function and urethroplasty. Based on the results of analyses a significant difference was observed in erectile function of subjects with pelvic fractures compared to those without pelvic fractures (10.43 ± 3.78 vs. 18.96 ± 3.18 ; $P = .001$). There was also a significant difference in erectile

function of patients with pelvic fractures between subjects with and without displacement of pubis symphysis (9.25 ± 3.72 vs. 11.55 ± 3.55 ; $P = .04$).

Univariate and multivariate analyses showed that urethroplasty did not significantly affect erectile function in patients according to penile color Doppler sonography and IIEF-5 erectile function questionnaire (13.12 ± 5.38 vs. 13.54 ± 5.44 ; $P = .26$). There was also no significant difference in erectile function of patients based on whether 3 or 6 months had passed from their urethroplasty (13.40 ± 5.53 vs. 13.12 ± 5.38 $P = .61$). In brief, the IIEF-5 score changed from 13.45 ± 5.43 before surgery to 13.12 ± 5.38 three months after surgery and finally 13.40 ± 5.53 six months after surgery.

Age, location and length of stricture had no significant effects on erectile function of patients before and after urethroplasty ($P > .05$), but stricture longer than 6 cm had a marginal *P* value of .06 in univariate analysis. **Table 3** shows that none of the evaluated variables were able to independently predict the effects of urethroplasty on erectile function of patients. **Table 4** presents the EDV and PSV of the right and left cavernosal arteries, before and after urethroplasty and **Table 5** shows the frequency of ultrasound findings, before and after urethroplasty.

DISCUSSION

ED is one of the important issues pointed out in the studies evaluating patients with urethral strictures after reconstruction surgeries. In the present survey we showed that urethroplasty does not significantly improve or aggravate erectile function in these patients according to findings of the IIEF - 5 questionnaire and ultrasound assessments of the penile vasculature.

Injuries of the posterior urethra in most trauma cases are associated with pelvic ring fractures which can lead to development of ED directly through injuries to the adjacent neurovascular structures, or indirectly via local inflammation, edema and fibrosis. Of the patients with pelvic fractures associated with urethral injuries, 42% develop ED while only 5% of subjects with pelvic fractures without urethral injuries develop this problem⁽¹¹⁾. The incidence of ED after trauma has been reported from 18 to 72% in different studies⁽¹²⁾. Although the relative effects of trauma and potential iatrogenic factors during urethroplasty reconstruction surgeries is still not clear⁽⁸⁾.

Koraitim et al. showed that ED is typically due to the primary trauma and rarely (2%) could be attributed to the urethroplasty after injury⁽⁴⁾. In another study, Berg-

Table 5. Frequency of ultrasound findings, before and 6 months after urethroplasty.

Color Doppler Ultrasound classification	Before urethroplasty	After urethroplasty
Normal N (%)	20 (30.7)	20 (30.7)
One-sided Arterial occlusion N (%)	8 (12.3)	4 (6.1)
Two-sided Arterial occlusion N (%)	3 (4.6)	5 (7.7)
One-sided Venous insufficiency N (%)	10 (15.4)	9 (13.8)
Two-sided Venous insufficiency N (%)	8 (12.3)	8 (12.3)
Mixed arterial & venous N (%)	16 (24.6)	19 (29.2)

er et al. found no significant change in development of ED (17%) after reconstructive urethroplasty of the posterior urethra⁽¹³⁾. Santucci et al. also reported only a 1% increase in the prevalence of ED after bulbar anastomotic urethroplasty in 168 patients⁽¹⁴⁾. Kessler et al. followed patients for a longer period of time after anastomotic urethroplasty and found only 2 new cases of ED among 40 patients with urethral injuries, among which 33% were bulbar, 10% were bulbomembranous and 57% were membranous injuries⁽¹⁵⁾. The results of these studies were congruent with the findings of the present study which showed urethroplasty to have no significant effects on erectile function of patients.

In their study in 1995, Mark et al. reported that older patients are more at risk for erectile dysfunction after pelvic fracture urethral distraction defects ($P = .013$)⁽¹⁶⁾. Although the present study found no significant difference in ED between different age groups, but this could be attributed to the fact that most patients included in our study were younger than 40 years old (92.3%). Mundy et al. reported that 53% of their patients developed ED after anastomotic urethroplasty within 3 months of the surgery, while after a one year follow up only 5% were still suffering from this problem⁽¹⁷⁾. In our study also, the mean score of erectile function at 6 months after urethroplasty (13.40 ± 5.53) was found to have improved compared to the figure calculated at 3 months (13.12 ± 5.38); however, the differences were not statistically significant.

In spite of difficulty in doing end to end anastomosis in cases of stricture length more than 5 centimeters, there has been reports of success by this technique even in children⁽¹⁸⁾. Considering the length of stricture, Gao et al. found a significant difference in incidence of ED between the two groups of patients with different stricture lengths after anastomotic urethroplasty: one comprised of 17 subjects with a mean stricture length of 2.3 ± 1.3 cm and the other including 35 patients with an average stricture length of 3.8 ± 1.1 cm⁽¹⁹⁾. We also found a marginal P value of 0.06 for development of ED in patients with strictures longer than 6 cm.

On the other hand, Morey and McAninch reported an improvement from 38% to 58% among patients with ED after urethroplasty and no new cases of ED were observed in their sample population⁽²⁰⁾. However, ED had improved in only 4 patients (6.1%) in the present study.

Anger et al. followed 25 patients who had underwent bulbar anastomotic urethroplasty for an average of 6.2 months and reported the mean score of IIEF to decrease from 62.2 to 59.6 from a total score of 75 and the mean score for erectile function to decrease from 26.9 to 24.6 from a total score of 30. However, these changes were found to be statistically insignificant⁽²¹⁾ which is compatible with the findings of the present survey.

In our study, based on IIEF - 5 questionnaire, erectile function had improved in 4 subjects (6.1%) and declined in 9 (13.8%). According to the color Doppler ultrasound assessment of penile vasculature, erectile function was found to have declined in 6 patients (9.2%) which could be attributed to neurogenic injuries that cannot be detected by ultrasonography.

The higher risk of erectile dysfunction in complex urethroplasty could be attributed to the extra manipulations in these subjects such as opening the crura, releasing the proximal urethra or inferior pubectomy for creating a

tension free anastomosis.

Despite improvements of erectile function in 4 patients according to IIEF-5 questionnaire, none of the patients were found to have improvement in their ultrasound findings, which can be the result of resecting fibrotic tissues (improvement in cavernosal nerve function) and psychological aspects of becoming catheter free, neither of which can be detected via ultrasound. These findings had not been assessed in previous studies. Limitations: This study may be limited by different factors. Although the total number of patients included in this study is considerable, the subgroup numbers are limited and this may affect our results negatively in subgroup analysis. Additionally, we have not performed specific assessments for neurogenic causes of ED and this may alter some of the results.

CONCLUSIONS

This is one of the few prospective studies evaluating erectile function after anastomotic urethroplasty simultaneously via color Doppler ultrasound of penile vasculature. The results of this study showed that anastomotic urethroplasty does not significantly affect erectile function in patients with urethral strictures and no independent predictors were identified for the effects of urethroplasty on erectile function of patients. Further investigations are required in which larger sample populations should be evaluated, subjects should be followed for a longer duration of time and specific neurogenic assessments for the etiology of ED should be performed. Application of other standard questionnaires designed for assessment of erectile function such as Brief Male Sexual Function Inventory (BMFSI) and Sexual Life Quality Questionnaire (SLQQ) is also recommended.

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CONFLICT OF INTEREST

The authors have nothing to declare.

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