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Original Article

Erectile dysfunction in anterior urethral strictures after urethroplasty with reference to vascular parameters

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ARTICLE INFO

Article history:

Received 3 April 2016

Accepted 10 July 2016

Available online 11 August 2016

Keywords:

Erectile dysfunction

Urethroplasty

Urethral stricture

ABSTRACT

Background: Relation of erectile dysfunction (ED) with urethroplasty has long been a subject of debate. Very few studies on subcontinent population are available in this regard and still rarer are studies assessing vascular parameters of ED following urethroplasty. The objective of the study was to assess the incidence and prevalence of ED in patients of urethral stricture disease, and to find out effect of urethroplasty on ED after six months of operation including vasculogenic aetiology after operation.

Methods: From January 2014 to December 2015, 35 subjects underwent urethroplasty. They were assessed pre- and postoperatively by International Index of Erectile Function (IIEF-5) and Pharmacological Colour Doppler Ultrasonography (PCDU) for a period of 6 months.

Results: Preoperative prevalence of ED assessed by IIEF was found to be 82.8%. Postoperative incidence of ED was 28.5% and new onset ED is 50%. There was no significant change in IIEF values and values of peak systolic velocity and resistive index of cavernosal artery over time.

Conclusion: There is significant prevalence of ED with urethral stricture. Despite significant postoperative incidence of ED after urethroplasty, the surgical procedure per se does not result in ED.

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<http://dx.doi.org/10.1016/j.mjafi.2016.07.001>

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Introduction

Erectile dysfunction (ED) is estimated to have a prevalence rate of 10–20% worldwide in males more than 20 years of age,¹ with the majority of studies reporting a rate closer to 20%.² About 2.3% prevalence of ED has been reported in patients with urethral stricture after urethroplasty. For management of anterior urethral strictures, buccal mucosa graft (BMG) urethroplasty (as first described by Humby et al.³ in 1941) and anastomotic urethroplasty (as described by Jordan et al.⁴ in 1914) are being widely used. ED post-urethroplasty has been a matter of debate for long. ED adversely affects quality of life. It can be psychogenic or organic. Normally, it is assessed by various questionnaires, of which International Index of Erectile Function (IIEF) is a tried and tested type.^{5,6} For assessment of vascular causes of ED, peak systolic velocity (PSV) and resistive index (RI) of penile blood flow are measured by Colour Doppler Ultrasonography, with cut-off values being 35 cm/sec and 0.9 for PSV and RI, respectively.⁷ Our study aims at detecting the incidence and prevalence of ED in patients of urethral stricture disease, and to find out effect of urethroplasty on ED after six months of operation including vasculogenic aetiology after operation.

Materials and methods

Our study was a prospective study conducted in the Department of Urology and Radiodiagnosis. The study population included patients attending urology outpatient department (OPD) and diagnosed with urethral stricture between January 2014 and December 2015.

Sample size and sampling design: considering 2.3% prevalence rate of presence of ED among the patients of urethral stricture⁸ and considering 95% confidence limit, absolute precision of 5, the initial sample size of 35 was calculated as per the formula $n_i = Z^2pq/e^2$ (where $Z = 1.96$, $p = 2.3$, $q = 97.7$, $e = 5$, and n_i = calculated initial sample size). As the initial estimated sample size is less than 10% of the total target population (about 15,000 urology OPD attendance/year of last three year average), the fpc (finite population correction) was not adopted.

Urology OPD was chosen purposively. After obtaining approval from the Institutional Ethical Committee, patients of urethral stricture were identified. The identified patients were assessed by various diagnostic modalities like retrograde urethrogram (RGU), micturating cystourethrogram (MCU), uroflowmetry and cystoscopy, and patients fit for operation (urethroplasty) were selected. Then the selected patients were counselled and consent for participation in the study was sought. The willing patients, who fulfilled the inclusion and exclusion criteria, were then admitted in the Department of Urology and recruited as study subjects in the cohort. Initial assessment included socio-demographic information along with preoperative assessment of ED. This was done by the International Index of Erectile Dysfunction (IIEF-5) score and Pharmacological Colour Doppler Ultrasonography (PCDU). The operations were performed by different surgeons using similar

infrastructure. After the operation, two more assessments of ED were performed, eight weeks and six months after the operation, respectively. One by one recruitment of study subjects was done during the first one year of study period till the cohort of 35 subjects was completed. The whole cohort was closed after final assessment of the 35th subject. Thus, 35 male patients of urethral stricture constituted the study subject cohort.

Inclusion criteria: Sexually active males with anterior stricture urethra requiring urethroplasty, who are willing to undergo intervention and follow-up.

Exclusion criteria: Mentally distressed patients as assessed by Kessler Psychological Distress Scale (K10) scale^{9,10} and patients having recurrent urethral stricture.

Study variables

Socio-demographic variables studied were age, education, occupation, and socio-economic status (modified and updated BG Prasad Scale). Morbidity related variables were site and length of the stricture, presence of any other comorbidity, operative procedure undertaken, development of ED following urethroplasty, and vascular flow to the penis before and after urethroplasty.

Parameters measured: Preoperative prevalence rate of ED in stricture urethra patients and incidence rate of ED after urethroplasty.

Study techniques: After proper evaluation by history and examination, patients who conformed to inclusion and exclusion criteria underwent the mentioned procedures.

1 Technique of Pharmacological Colour Doppler Ultrasonographic study (PCDU):

After proper counselling regarding the procedure and the complications, the patients were subjected to Colour Doppler flow study of flaccid penis done in supine position with the penis on the anterior abdominal wall. With the (7.5–14 MHz) linear array transducers, the study was done from glans to base. PSV and RI of cavernosal artery were consistently measured at the junction of the proximal one-third and distal two-third of the penile shaft. After that, 30–60 mg of Papaverin was injected in the corpora cavernosa avoiding the 11 and 1 'o' clock positions. Patients were left alone for 2–3 min with a visually stimulative media if required. PSV and RI were again measured serially till maximum PSV was reached. PSV 35 cm/s and RI of 0.9 were taken as cut-off values.

2 Technique of urethroplasty:

Buccal/lingual mucosal graft (BMG/LMG) urethroplasty was done in strictures, which were more than 2 cm and in pan urethral strictures. With the patient in dorsal lithotomy position, a midline perineal incision was given. After separation of Colles' fascia and bulbo-spongiosus muscle, urethra was mobilized in one side of the diseased segment. BMG was harvested from the inner surface of either cheek (distal extent being about 1 cm from the vermilion border and proximal extent as required), taking care to avoid the Stensen's duct orifice (parotid duct) that lies opposite to the crown of upper second molar tooth. Dissection was done in the submucosal plane. LMG was harvested from ventral

surface of tongue from proximal to distal end, with dissection being done in the submucosal plane, and taking care not to injure the lingual nerve and Wharton's duct (submandibular duct). Dorsal onlay graft urethroplasty was done with placement of the graft dorsally after proper defatting.

Anastomotic urethroplasty was done in bulbar urethral strictures up to 2 cm. After exposure of the bulbar urethra, the stricture segment was excised and end-to-end anastomosis was done in a standard fashion. Mobilization of the urethra up to penobulbar part was done to achieve a tension-free anastomosis in selected cases. The perineum was then closed in layers.

Study procedure: Data collection was started after obtaining concerned permission from the study subjects. Information pertaining to demographic and socio-economic status was obtained by interview and data obtained from clinical examination, record review and investigation reports performed at the institute were documented in a format as required.

Statistical analysis: The collected data were compiled in MS Excel spreadsheet to prepare a master chart, and then was presented using different statistical methods. For descriptive statistics, mean, median, range, standard deviation, simple proportion, incidence and prevalence were calculated, and to draw inference, tests of significance, e.g. chi square test, exact, Kendall's W, Wilcoxon's signed rank, Friedman's test and odds ratio with 95% confidence interval (CI), were used using SPSS Version 21 and Epi Info Version 7.0.

Results

All of the 35 men included in the study completed the follow-up. They were aged between 20 and 60 years with a mean of 38.89 years. Of the patients, 14 were in the age group of 41–50 years, i.e. 40% of the patients. 37.1% were below 30 years, and only 8.1% were in the age group of 31–40 years. The rest 5 (14.2%) were between 51 and 60 years.

Cystoscopic examination conformed to the radiological findings. Bulbar urethral stricture was present in 19 patients (54.29%). Pan urethral stricture and stricture of proximal penobulbar and penile urethral stricture were present in 17.10%, 14.30% and 14.30%, respectively.

The length of the stricture after intraoperative assessment showed length up to 2 cm in 18 (51.5%) of the patients. Strictures more than 2.5 cm were present in about 45.7% of the population (Table 1).

Before urethroplasty, all study subjects were evaluated with baseline IIEF scoring to detect presence of ED. The value ranged from 13 to 23 (mean IIEF 18.97 ± 2.33). Further grouping was done with IIEF scale (where IIEF value more than 22 is regarded as no ED, IIEF value between 17 and 21 as mild ED, value within 12–16 as mild-moderate ED, value between 8 and 11 as moderate ED and IIEF less than 8 as severe ED). The results were as follows:

Of all the study subjects, 71.40% had mild and 11.40% had mild-moderate type of ED with total prevalence of 82.80% (29/35) of ED among all patients with urethral stricture (Table 2).

Table 1 – Length of stricture as found during surgery (N = 35).

Length of stricture in cm	Frequency (n)	Percent (%)
1	1	2.90
1.5	3	8.60
2	14	40.00
2.5	1	2.90
4	2	5.70
5	5	14.30
6	3	8.60
PAN (anterior urethral)	6	17.10
Total	35	100.00

Table 2 – Prevalence of erectile dysfunction (ED) among study subjects (N = 35).

Erectile dysfunction (ED)	Frequency (n)	Percent (%)
No ED	6	17.20
Mild ED	25	71.40
Mild-moderate ED	4	11.40
Total	35	100.00

Urethroplasty was done after further evaluation of other physiological parameters, e.g. baseline PSV and Papaverine-induced PSV along with RI of penile blood flow. Four types of operation were adopted, namely anastomotic, BMG, LMG or a combination of BMG and LMG as per nature of stricture.

In our patients, 14 (51.5%) underwent anastomotic urethroplasty. The rest had free graft in the form of BMG or LMG or both.

All study subjects were examined for PSV of penile blood flow and RI at different points of time. All the observed data were non-normally distributed, so comparison of means was done applying non-parametric tests of significance for related samples, e.g. Kendall's W and Wilcoxon's signed rank test for comparison of IIEF score.

When post-Papaverine injection erection states were compared, there was initial decrease in blood flow at eight weeks after operation and later rise in PSV value at six months after operation. The change was insignificant ($P = 0.229$) (Table 3).

The RI did not show any significant change after urethroplasty at 8 weeks and 6 months postoperatively ($P = 0.135$) (Table 4).

Similarly, IIEF values, measured before and after operation, were compared and differences in values were compared. There was worsening in 10 (28.50%) cases of which 7 had ED preoperatively. New onset ED was noted in 3 patients. In 14 subjects (40.00%), there were no changes in IIEF score while 11 subjects (31.50%) showed improvement. Overall, there was negative change in IIEF score ($z = -0.396$) but the change was not statistically significant ($P = 0.692$) (Table 5).

Incidence of postoperative ED was 28.50% (10/35), while new onset ED incidence was 50% (3 out of 6 non-ED subjects developed ED).

On further evaluation, PSV, RI and IIEF values were compared across different groups based on type of stricture, operation adopted, age, religion and socio-economic status (SES) of study subjects.

Table 3 – Comparison of PSV values observed at different times of study among study subjects (N = 35).

PSV	N	Descriptive statistics					Analytical statistics			
		Mean	SD	Percentiles			Mean rank	Kendall's W	χ^2	P
				25th	50th (median)	75th				
Preoperative	35	48.34	14.67	32.00	46.000	60.00	2.00	0.042	2.947	0.229
After 8 weeks	35	46.37	15.65	32.00	46.00	56.00	1.80			
After 6 months	35	50.09	18.81	35.00	45.00	66.00	2.20			

Table 4 – Comparison of RI values observed at different time of study among study subjects (N = 35).

Resistive index	N	Descriptive statistics					Analytical statistics			
		Mean	SD	Percentiles			Mean rank	Kendall's W	χ^2	P
				25th	50th (median)	75th				
Preoperative	35	0.897	0.0169	0.90	0.900	0.900	2.06	0.057	4.00	0.135
After 8 weeks	35	0.891	0.0284	0.90	0.900	0.900	1.97			
After 6 months	35	0.891	0.0284	0.90	0.900	0.900	1.97			

Freidman's test was applied for more than two related samples and Wilcoxon's Z test for two related samples. On associating IIEF with type of strictures, it showed that bulbar strictures contributed for negative changes (mean IIEF rank changes to 19.55 from 19.70 in bulbar type and to 11.20 from 11.60 in penobulbar type after operation) and penile variety showed better prognosis (penile 17.63–18.50 and pan urethral 17.93–18.36). Overall, IIEF score changes among different type of strictures was detrimental after operation (Wilcoxon's Z was -0.730) but it was not significant at $P < 0.05$ level ($P = 0.465$). Of different operations, LMG alone showed best result (IIEF change 12.17–24.50) while combination of LMG and BMG exerted less improvement (6.25–9.00), and anastomotic (19.61–19.21) and BMG alone (19.16–16.78) had negative prognosis. Overall, different operative procedures showed insignificant negative impact on IIEF score ($z = -0.714$, $P = 0.468$).

Similarly, it was found that all co-variables were insignificantly associated with changes in PSV and RI (Tables 6 and 7).

Discussion

Erectile dysfunction can be caused by altered blood flow through arteries, defective venous engorgement or absent neural transmission. As described by Lue et al.¹¹ cavernosal nerves mostly traverse about 3 mm outside cavernosa and only few traverse through it. So anatomically, there seems to be minimal risk to erectile neural mechanism after urethroplasty.

Various literatures have shown varying results of ED following urethroplasty depending on site, size and operative techniques.

Studies by Palminteri et al.,¹² Shenfeld et al.,¹³ Kessler et al.,¹⁴ Anger et al.¹⁵ and Nelson et al.¹⁶ concluded that there

Table 5 – Wilcoxon signed ranks test for comparison of change in IIEF values observed at two different time of study among study subjects (N = 35).

Change in IIEF value	Ranks			Statistics	
	N	Mean rank	Sum of ranks	Z	P
Negative ranks	10	10.45	104.50	-0.396	0.692
Positive ranks	11	11.50	126.50		
Ties	14	–	–		
Total	35	–	–		

Table 6 – Association of PSV changes with different parameters (N = 35).

Parameters (N = 35)	Ranks			Statistics	
	PSV mean rank			χ^2	P
	Mean $\pm$ SD Preoperative	Mean $\pm$ SD At 8 weeks	Mean $\pm$ SD At 6 months		
Stricture	18.75 $\pm$ 4.65	18.85 $\pm$ 2.76	17.81 $\pm$ 1.43	0.500	0.931
Operation	18.46 $\pm$ 1.85	20.97 $\pm$ 4.86	19.26 $\pm$ 2.01	0.000	1.000
Age group	16.93 $\pm$ 8.78	17.44 $\pm$ 8.33	16.59 $\pm$ 7.55	0.500	0.939
SES (socio-economic status)	13.00 $\pm$ 8.1	14.12 $\pm$ 6.56	14.75 $\pm$ 4.99	1.733	0.657

Table 7 – Association of RI changes with different parameters (N = 35).

Parameters	Ranks			Statistics	
	RI mean rank			χ^2	P
	Mean $\pm$ SD Preoperative	Mean $\pm$ SD At 8 weeks	Mean $\pm$ SD At 6 months		
Stricture	17.87 $\pm$ 1.25	18.41 $\pm$ 1.28	18.41 $\pm$ 1.28	2.000	0.686
Operation	18.22 $\pm$ 0.55	18.60 $\pm$ 1.18	18.60 $\pm$ 1.18	2.000	0.629
Age group	18.19 $\pm$ 0.63	17.96 $\pm$ 1.45	17.96 $\pm$ 1.45	0.000	1.000
SES (socio-economic status)	14.12 $\pm$ 8.75	14.55 $\pm$ 8.38	14.55 $\pm$ 8.38	2.000	0.571

is hardly any ED after urethroplasty in any form. Even an Indian study by Singh et al.¹⁷ showed that urethral reconstructive surgery does not significantly affect erectile function postoperatively.

On the other hand, Mundy¹⁸ reported ED, within 3 months, in 53% of the patients after anastomotic urethroplasty and 33% of the patients after augmentation urethroplasty. Eltahawy et al.⁸ and Santucci et al.¹⁹ report an incidence of ED in less than 1% after anastomotic bulbar urethroplasty. Incidences in the range of 5–26% have been reported after anastomotic urethroplasty for anterior urethral strictures.^{20,21} Interestingly Carlton et al.²² observed that the initial injury, not the reconstructive surgery, is responsible for most of the long-term ED.

The available meta-analysis by Feng et al.²³ included 23 cohort studies with 1729 cases. They found no significant difference in ED in patients after intervention (odds ratio [OR] = 0.86; 95% confidence interval [CI]: 0.52–1.40; P = 0.53). The incidence of ED appears to be higher in the bulbar anastomotic group than in the augmentation urethroplasty group (OR = 0.32 95% CI: 0.11–0.93; P = 0.04). Interestingly literatures comparing PSV after urethroplasty were hard to find.

In our study, the new cases of ED were those patients who had undergone free graft urethroplasty. Retrospective analysis showed that all of them had complications of urethroplasty, i.e. development of urethral fistula and newly developed stricture.

Our study showed that free graft urethroplasty or anastomotic urethroplasty did not affect postoperative outcome of PSV and RI. There was also no significant change in IIEF score over time.

The paradoxical result of incidence may be explained by the fact that psychological factor plays a dominant role in ED. K10 test cannot rule out all psychological components of ED. The effect of the disease itself may play the dominant role.

The limitation of the study was that detailed psychometric analysis was not done, and the associations of duration of the disease and postoperative complications were not statistically analyzed; neurological assessment was also not a part of the study, as these have also been shown, in various studies, to affect erectile function. But it should be noted that for psychometric analysis, nerve conduction study was hardly used in any available literatures for assessment after urethroplasty.

Conclusion

The prevalence of ED associated with urethral stricture disease is high (82.85%). Postoperative incidence following

urethroplasty is 28.50%, with new onset ED being 50%. However, this incidence could not be significantly related to urethroplasty. The vascular events that may result in ED are not significantly noted after these procedures. The incidence of ED after surgery may be attributed to the pre-existing disease or any psychogenic cause. Further studies should include psychometric analysis along with the study.

Conflicts of interest

The authors have none to declare.

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