

Prospective study of *de novo* sexual dysfunction after anterior urethroplasty: Causative factors, incidence, and recovery of function – A single-center experience

Prasenjit Bhowmik, Gaurav Sharma, Pramod Kumar Sharma, Piyush Kumar Patawari, Sumantra Dey, Soumendranath Mandal

Department of Urology, Calcutta National Medical College and Hospital, Kolkata, West Bengal, India

Abstract

Objectives: The objectives of this study were to evaluate the effect of single-stage anterior urethroplasty on sexual function by considering age, stricture length, location, and different surgical techniques. Incidence of postoperative sexual dysfunction (SD) and probability of recovery were also highlighted.

Materials and Methods: A total of 115 patients undergoing anterior urethroplasty from February 2016 to June 2020 were evaluated prospectively. Patients were categorized on the basis of age, location, length of stricture as well as surgical techniques. We evaluated three domains of sexual function (erectile, orgasmic, and overall satisfaction) using the International Index of Erectile Function (IIEF) preoperatively and then after 3 months and 6 months postoperatively in follow-up. Pre- and postoperative IIEF values were compared.

Results: The mean age was 41.7 ± 13.9 years. There was a significant decrease in postoperative IIEF score from the preoperative value in older patients (>40 years) along with poor recovery at the 6th month as compared to patients of younger age group (≤ 40 years). However, there was a significant reduction of sexual function postoperatively in case of longer stricture segment, panurethral stricture, bulbar urethral stricture, dorsal buccal mucosal urethroplasty, and excision-primary anastomosis technique in univariate analysis, but on multivariate analysis, only age was proved to be an independent predictor of *de novo* SD which was found in a total of 28 patients (24.3%).

Conclusion: Overall, anterior urethroplasty does not influence postoperative sexual function, whereas only older patients have a poor outcome. Most of the younger patients recover completely by 6 months.

Keywords: Anterior urethral stricture, International Index of Erectile Function, sexual dysfunction, urethroplasty

Address for correspondence: Dr. Pramod Kumar Sharma, Department of Urology, Calcutta National Medical College and Hospital, Kolkata - 700 014, West Bengal, India.

E-mail: dr.pramodkumarsharma@outlook.com

Received: 04.02.2021, **Accepted:** 25.06.2021, **Published:** 25.09.2021.

INTRODUCTION

Urethral stricture disease (USD) is characterized by fibrosis and scarring of the corpus spongiosum, resulting

in concomitant narrowing of the urethral lumen. It is multifactorial in etiology consisting mostly of iatrogenic, traumatic, infective, and idiopathic factors. It is usually

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: WKHLRPMedknow_reprints@wolterskluwer.com

How to cite this article: Bhowmik P, Sharma G, Sharma PK, Patawari PK, Dey S, Mandal S. Prospective study of *de novo* sexual dysfunction after anterior urethroplasty: Causative factors, incidence, and recovery of function – A single-center experience. *Urol Ann* 2022;14:60-6.

Access this article online	
Quick Response Code:	Website: www.urologyannals.com
	DOI: 10.4103/ua.ua_24_21

associated with a negative impact on a patient's quality of life from the disease process itself as well as from its complications also. It can be managed by different treatment modalities: dilatation, direct vision internal urethrotomy, and open reconstruction. Among all these modalities, reconstructive surgery is considered a superior treatment option in terms of better long-term results, low morbidity, less chance of recurrence, and cost-effectiveness. Hence, urethroplasty is accepted as the gold standard treatment of USD.^[1] However, it involves a high chance of injury to the cavernous nerve, pudendal nerve, bulbar artery, and bulbospongiosus muscle responsible for normal erectile and ejaculatory function as dissection during the operation is carried out near these structures.^[2] That's why *de novo* erectile dysfunction (ED) and ejaculatory dysfunction are important complications after reconstructive surgery. Mundy was the first urologist who reported ED after urethroplasty in 1993.^[3] Although the primary focus of urethral reconstruction is to alleviate lower urinary tract symptoms (LUTS) due to stricture without jeopardizing normal sexual function, the incidence of *de novo* sexual dysfunction (SD) is largely underreported to date.

In this study, we aim to assess the impact of anterior urethroplasty on the sexual aspect in terms of erectile, ejaculatory (orgasmic), and overall satisfaction function taking into account certain parameters, i.e. age, location, length of stricture, and surgical technique, the incidence of SD, and probability of functional recovery.

MATERIALS AND METHODS

This is a prospective study conducted from February 2016 to June 2020 among patients who underwent single-stage urethroplasty for anterior USD at our department of urology of a tertiary care hospital. This study was approved by the ethical committee of our institution (Memo No. CNMCandH/2016/041 on January 10, 2016). All patients gave their informed consent in writing before participating in the study.

Study population

We analyzed 216 patients with USD aged between 18 and 65 years. All patients with age <18 years, sexually inactive, preexisting ED as assessed by the International Index of Erectile Function (IIEF), pelvic fracture urethral injury, history of straddle injury, inability to understand IIEF scoring system, and staged urethroplasty were excluded from our study. After exclusion, 152 patients became eligible for this study. Again, a total of 37 patients did not turn up to follow-up during this study period. Ultimately,

115 patients were available for final analysis with a normal preoperative IIEF score [Figure 1].

Study procedure and surgical technique

All selected patients were stratified according to age, stricture length, location, and surgical techniques. Stricture length and location were determined by preoperative retrograde urethrogram (RGU) and voiding cystourethrogram (VCUG). All patients were evaluated with proper history, physical examination, urine routine microscopy and culture, ultrasonography of kidney, ureter, and bladder, uroflowmetry, RGU, and VCUG. Sexual function was assessed by IIEF questionnaire (15 questions) before and after surgery (at 3 months and 6 months in follow-up) and compared with each other. Preoperatively, data were collected after admission and postoperatively at our follow-up clinic. Under sexual function, we assessed three important domains, i.e. erectile function (Q1-5, known as IIEF-5), orgasmic function (Q9, 10), and overall satisfaction (Q13, 14). ED was classified according to IIEF-5 score as no ED (22–25), mild (17–21), mild to moderate (12–16), and severe (5–7).^[4]

The operative technique was planned based on the length and location of the stricture as well as the general condition of the patient. It includes excision and primary anastomosis (EPA) for <3 cm bulbar urethral stricture, double facing urethroplasty (DFU) for near-obliterative short-segment bulbar stricture, ventral onlay buccal mucosal graft urethroplasty (VBMGU) for proximal bulbar, and dorsal onlay buccal mucosal graft urethroplasty (DBMGU) for distal bulbar, long-segment bulbar (>5 cm), panurethral, and penile urethral stricture.

During surgery, we tried to restrict the dissection field as close to the bulbar urethra as possible to preserve

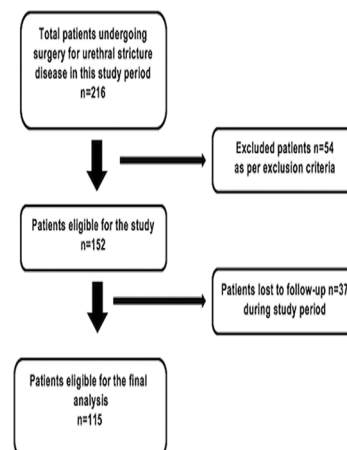


Figure 1: Flowchart of patient accrual

neurovascular structures and bulbospongiosus muscle. DBMGU was performed according to Barbagli technique^[5] with dorsal stricturotomy 1 cm further into the apparently normal-looking urethra on either side of the stricture and placement of buccal mucosal graft (BMG) in dorsal onlay fashion. In VBMGU, BMG was applied ventrally in onlay technique after ventral stricturotomy followed by spongioplasty. EPA was conducted by excision of the diseased segment and 1 cm spatulation of urethra on each side followed by anastomosis of two ends. In DFU, we combined both techniques of DBMGU and VBMGU. All surgeries were performed by the same surgeon well-versed in urethroplasty techniques.

In the postoperative period, per urethral catheter (PUC) was removed after 3 weeks of surgery if VCUG was normal and urine flow was assessed by uroflowmetry study. Patients were advised to resume their normal sexual life 2 weeks after PUC removal.

Statistical analysis

We analyzed our data by using IBM SPSS statistics version 22 (IBM, Chicago, IL, USA) software. The normality of our study data was assessed by the Shapiro–Wilk test. As our study data were nonparametric without normal distribution, we did the univariate analysis with Wilcoxon signed-rank test for intragroup, Mann–Whitney *U*-test for two intergroup comparisons, and Kruskal–Wallis test for more than two intergroup comparisons. Multivariate linear regression analysis was also used taking age, stricture length, location, and types of surgery as variables that might affect the sexual outcomes after urethroplasty. *P* < 0.05 was considered statistically significant.

RESULTS

We divided our patients into two age groups, i.e. 18–40 years and 41–65 years. The mean age of our patients was 41.7% ± 13.9. Fifty-three percent of patients were under 40 years while 47% being above 40 years. According to stricture location, 58.3% of strictures were located at the bulbar area, 26.1% at penile urethra, with the rest 15.6% having panurethral stricture (PUS). Length of stricture was divided into three groups, i.e. <3 cm, 3–5 cm, and >5 cm which comprised 26.1%, 30.4%, and 43.5% of cases, respectively, with a mean length of 5.2 ± 2.9 cm. We performed DBMGU in 69.6%, VBMGU in 15.6%, DFU in 4.4%, and EPA in 10.4% of patients. The mean preoperative IIEF-5 score was 22.7 ± 0.9 while postoperative IIEF-5 scores at 3 months and 6 months were 20.6 ± 4.5 and 22.2 ± 2.1, respectively. The mean orgasmic function scores at preoperative and 3 months and 6 months postoperatively were 7.8 ± 0.9,

6.6 ± 1.6, and 7.6 ± 1.17, respectively. Similarly, the mean overall satisfaction scores at preoperative and 3 months and 6 months postoperatively were 7.7 ± 0.7, 6.9 ± 1.2, and 7.5 ± 0.87, respectively, [Table 1].

In age group analysis, there was a statistically significant difference between preoperative and 3-month postoperative IIEF-5 scores in age group >40 years (*P* < 0.001), while in <40 years, this difference was not statistically significant (*P* = 0.053). A statistically significant decrease (*P* < 0.001) was also seen in 3-month postoperative IIEF-5 score in older age group patients (41–65 years) when comparison was done with that of the younger age group patients (18–40) [Table 2]. Orgasmic and overall satisfaction scores followed a similar trend to the IIEF-5 score [Table 2].

As per stricture location, there was a statistically significant change in the patient’s pre- and postoperative IIEF-5 scores in bulbar and PUS with *P* < 0.001 and 0.027, respectively. However, 3-month postoperative IIEF-5 score had been significantly dropped in PUS and bulbar stricture as compared to penile stricture with *P* < 0.001 [Table 2]. Change of orgasmic function was also significant like IIEF-5 value [Table 2]. However, postoperative overall satisfaction function change was not statistically significant (*P* = 0.088) when it was compared among three location categories [Table 2].

Table 1: Assessment of baseline characteristics of study population

Parameters	Groups	n (%)	Mean±SD	<i>P</i> *
Age (years)	18–40	61 (53)	41.7±13.9	
	41–65	54 (47)		
Site of stricture	Penile	30 (26.1)	5.2±2.9	
	Bulbar	67 (58.3)		
	Panurethral	18 (15.6)		
Length of stricture (cm)	<3	30 (26.1)	5.2±2.9	
	3–5	35 (30.4)		
	>5	50 (43.5)		
Surgery	DBMGU	80 (69.6)		
	VBMGU	18 (15.6)		
	DFU	5 (4.4)		
	EPA	12 (10.4)		
IIEF-5	Preoperative		22.7±0.9	<0.001
	Postoperative (3 months)		20.6±4.5	
	Postoperative (6 months)		22.2±2.1	
Orgasmic function	Preoperative		7.8±0.9	0.023
	Postoperative (3 months)		6.6±1.6	
	Postoperative (6 months)		7.6±1.17	
Overall satisfaction	Preoperative		7.7±0.6	0.041
	Postoperative (3 months)		6.9±1.2	
	Postoperative (6 months)		7.5±0.87	

*Wilcoxon signed-rank test. IIEF: International Index of Erectile Function, DBMGU: Dorsal onlay buccal mucosal graft urethroplasty, VBMGU: Ventral onlay buccal mucosal graft urethroplasty, DFU: Double facing urethroplasty, EPA: Excision and primary anastomosis, SD: Standard deviation

Table 2: Assessment of pre- and postoperative sexual function (International Index of Erectile Function-5, orgasmic function, and overall satisfaction function) between and within different study parameters (age, location, length, and surgical techniques)

	IIEF-5			Orgasmic function			Overall satisfaction		
	Preoperative (mean±SD)	Postoperative (3 months)	P*	Preoperative (mean±SD)	Postoperative (3 months)	P*	Preoperative (mean±SD)	Postoperative (3 months)	P*
Age (years)									
18-40	23.11±1.08	22.80±1.83	0.053	8.21±0.9	8.11±1.08	0.063	7.87±0.72	7.74±0.9	0.063
41-65	22.22±0.46	18.22±5.32	<0.001	7.33±0.75	6.39±1.46	<0.001	7.52±0.54	6.63±1.17	<0.001
P**		<0.001			<0.001		<0.001	<0.001	
Location									
Penile	23.4±1.1	23.1±1.7	0.109	7.93±0.83	7.70±1.05	0.059	7.57±0.57	7.37±0.72	0.063
Bulbar	22.5±0.8	20.2±3.5	<0.001	7.91±0.99	7.04±1.72	<0.001	7.84±0.71	7.06±1.30	<0.001
Pan-urethra	22.3±0.5	20.4±3.01	0.027	7.17±0.62	6.39±1.42	0.014	7.44±0.51	6.55±1.15	0.008
P†		<0.001			0.021			0.088	
Length									
<3	23.03±1.17	22.40±2.33	0.053	8.3±0.84	8.10±1.19	0.063	7.70±0.75	7.43±1.05	0.063
3-5	22.83±1.03	22.00±2.89	0.068	8±0.98	7.80±1.28	0.066	8.06±0.64	7.88±0.92	0.063
>5	22.40±0.60	20.28±3.15	<0.001	7.36±0.75	6.54±1.40	<0.001	7.46±0.50	6.7±1.05	<0.001
P†		0.002			<0.001			<0.001	
Surgery									
DBMGU	22.12±0.33	18.31±5.35	<0.001	7.59±0.93	6.94±1.56	<0.001	7.53±0.56	7.00±1.09	<0.001
VBMGU	23.39±1.00	23.22±1.27	0.317	8.55±0.95	8.5±1.07	0.317	8.50±0.60	8.44±0.68	0.317
DFU	22.40±0.49	21.80±1.17	0.180	7.4±0.49	6.2±1.33	0.180	8.00±0.63	6.8±1.47	0.157
EPA	22.25±0.43	20.42±2.63	0.033	8.00±0.82	7.00±1.73	0.043	7.58±0.49	6.58±1.04	0.043
P†		0.006			0.001			<0.001	

*Wilcoxon signed-rank test, **Mann-Whitney U-test, †Kruskal-Wallis test. IIEF: International Index of Erectile Function, DBMGU: Dorsal onlay buccal mucosal graft urethroplasty, VBMGU: Ventral onlay buccal mucosal graft urethroplasty, DFU: Double facing urethroplasty, EPA: Excision and primary anastomosis, SD: Standard deviation

Change of postoperative IIEF-5 was also found to be statistically significant ($P < 0.001$) from the preoperative value in the case of stricture length >5 cm. However, postoperative changes of IIEF-5 were also statistically significant ($P = 0.002$) when it was compared between different length groups [Table 2]. The other two domains demonstrated a similar kind of significant change like IIEF-5, as shown in Table 2.

Type of surgical technique analysis showed a statistically significant change in IIEF-5 score after DBMGU and EPA with $P < 0.001$ and 0.033 , respectively, when pre- and postoperative values were compared. Similarly, in intergroup comparison of four surgical techniques, a statistically significant difference was also present in the IIEF-5 score ($P = 0.006$) [Table 2]. A similar significant change was also seen in the other two domains of sexual function as found in IIEF-5 [Table 2].

The comparison of pre- and 3-month postoperative IIEF-5 scores among different study variables is depicted in Figure 2.

Overall, postoperatively 24.3% (28/115) of patients had decreased IIEF score at 3 months, but recovery of all three sexual functions was noted in almost all patients by 6 months except 3 patients. This improvement after 6 months postoperatively was statistically significant ($P < 0.001$, 0.023 , and 0.041 in IIEF-5, orgasmic, and satisfaction

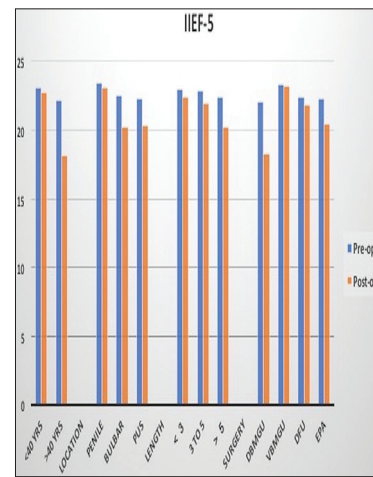


Figure 2: Comparison of preoperative and 3-month postoperative International Index of Erectile Function-5 score among different study parameters

function, respectively) [Table 1 and Figure 3]. These three patients belonged to the older age group and were evaluated further and treated by medication.

However, multivariate analysis showed only age ($P = 0.001$, <0.001 , and 0.002) to be an independent predictor of postoperative SD after urethroplasty [Table 3].

DISCUSSION

De novo SD in the form of ED, ejaculatory dysfunction, penile shortening, curvature, chordee, and genital numbness

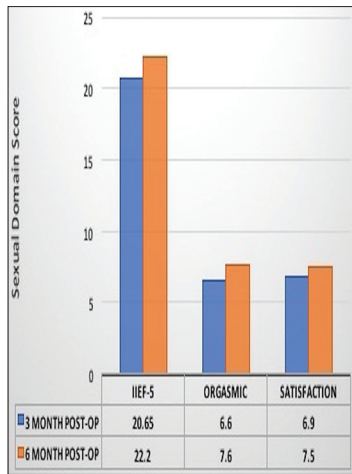


Figure 3: Comparison of 3-month and 6-month postoperative sexual function in total study population

is a well-known complication after urethroplasty. However, different literatures showed different results of SD which was thought to be affected by patient’s age, preoperative sexual function, site, size, the severity of stricture, and different surgical techniques.^[6-9]

The association of ED after urethroplasty with age is somehow varied in various studies. Johannes *et al.*^[9] and Haines and Rourke^[10] showed that patients older than 50 years were associated with decreased postoperative erectile function and prolonged time of recovery owing to the factors such as the increased likelihood of different comorbidities, poor preoperative erectile function, or loss of tissue pliability. Johannes *et al.* found that the frequency of ED was an increasing trend with age which was 5% below 40 years and 15% around 60 years.^[9] However, some literature contradicts this opinion, demonstrating no impact of age on SD following urethroplasty.^[11]

In our study, we found that the preoperative IIEF-5 score was decreased significantly in the postoperative period in patients above 40 years of age, but not in patients under 40 years of age. Similar findings were also noted in orgasmic and overall satisfaction function as found in IIEF-5. These findings corroborate with the existing studies that older patients are more susceptible to develop *de novo* SD after urethroplasty, perhaps due to the risk factors such as loss of tissue pliability, obesity, smoking, diabetes mellitus, uncontrolled hypertension, ischemic heart disease, preexisting undiagnosed neurovascular disease, or benign prostatic enlargement.

In the study conducted by Xie *et al.*,^[12] a significant decrease in IIEF score was reported after 3 months postoperatively followed by significant improvement after 6 months

Table 3: Multivariate (linear regression analysis) analysis to identify independent factors of sexual dysfunction

Variables	B (95% CI)	P
IIEF-5		
Age	-0.149 (-0.2--0.06)	0.001
Stricture length	-0.366 (-0.98--0.24)	0.238
Stricture location	1.941 (-0.04--3.9)	0.054
Surgery	0.262 (-0.43-0.96)	0.457
Orgasmic function		
Age	-0.056 (-0.086--0.027)	<0.001
Stricture length	-0.065 (-0.271-0.140)	0.529
Stricture location	-0.024 (-0.689-0.640)	0.943
Surgery	0.078 (-0.156-0.312)	0.510
Overall satisfaction		
Age	-0.039 (-0.064--0.015)	0.002
Stricture length	0.05 (-0.123-0.222)	0.569
Stricture location	-0.356 (-0.914-0.214)	0.268
Surgery	0.162 (-0.035-0.358)	0.106

IIEF: International Index of Erectile Function, CI: Confidence interval

with conservative treatment. This study also stated that post-urethroplasty ED usually takes around 6 months for complete recovery in patients below 40 years but takes a longer time to resolve in the older patient population. Another study by Erickson *et al.*^[8] also demonstrated that the frequency of ED was rare after 1 year of surgery, but it persisted for a prolonged time in older age patients. Dogra *et al.*^[13] also showed postoperative ED in 20% of the study cohort which was also transient. They described the initial drop of postoperative IIEF score after 3 months significantly ($P = 0.002$), but it again gradually improved after 6 months postoperatively. In our study, we found that 24% of total patients undergoing urethroplasty reported significant *de novo* SD at 3 months after surgery. This postoperative SD improved gradually without any intervention at 6 months which was statistically significant. Older patients above 40 years did not recover well after 6 months as compared to younger patients. These results are compatible with the above literature.

In literature, most of the studies established reduced or the same sexual function after urethroplasty. However, few studies like Erickson *et al.*^[8] proposed that urethroplasty may improve a mean orgasmic score while the other two scores remain unaffected due to removal of scar tissue and re-establishment of a healthy continuous urethral lumen and bulbospongiosus muscle. They also suggested semen volume measurement for better prediction of ejaculatory function. Our study also highlighted the improvement of postoperative IIEF scores in few patients.

In a study done by Erickson *et al.*,^[14] erectile function was found to be affected more in the case of bulbar urethra than penile urethra which seemed to be caused by the close proximity of the bulbar urethra to the cavernosal nerve. Dogra *et al.*^[15] also reported that there was a higher

chance of ED after transecting bulbar urethroplasty than nontransecting one or penile urethroplasty. However, Haines and Rourke showed no relation between stricture location and ED in their study.^[10] When we examined our data, we found that there was a significant change in all three sexual domains postoperatively in bulbar and PUS as compared to penile urethra. However, in regression analysis, it was proved that the location of stricture has no role in predicting postoperative SD independently.

Few contradictory literatures are there demonstrating the effect of stricture length on postoperative *de novo* SD. Studies done by Xie *et al.*,^[12] Dogra *et al.*,^[13] and Blaschko *et al.*^[16] concluded no statistically significant effect of stricture length on the occurrence of *de novo* SD after urethroplasty. However, Coursey *et al.*^[17] showed a frequent change of an erectile function with long-segment stricture. We analyzed our data and established a similar finding that the length of the stricture segment was not independently associated with worsening sexual function in the postoperative period.

When assessing the impact of the type of urethroplasty, Mundy reported ED in 53% of patients after anastomotic urethroplasty and 33% after augmentation urethroplasty within 3 months.^[3] Other studies conducted by Coursey *et al.*^[17] and Al-Qudah and Santucci^[18] reported an incidence of ED around 5%–26% after anastomotic urethroplasty for anterior USD. Eltahawy *et al.*^[19] and Santucci *et al.*^[20] showed an incidence of ED <1% after anastomotic bulbar urethroplasty. However, there was no postoperative SD after any sort of urethroplasty mentioned in the studies done by Palminteri *et al.*,^[21] Kessler *et al.*,^[22] Anger and Sherman,^[23] Shenfeld *et al.*,^[24] and Nelson *et al.*^[25] Another Indian study by Singh *et al.*^[26] also noted no influence of urethroplasty on sexual function. Our study demonstrated that a decrease in sexual function was higher in patients who underwent DBMGU and EPA than the other procedures with a statistically significant difference. However, multivariate analysis showed that surgical technique was not an independent predictor of postoperative sexual function outcomes.

In our study, there might be some anatomical basis for decrement of erectile function after DBMGU apart from the degree and duration of urethral mobilization in long-segment stricture. According to Lue *et al.*,^[27] cavernosal nerve fibers mostly traverse 3 mm away from the corpus spongiosum at 11 and 1 o'clock position, implicating that there is little chance of injury to these nerve fibers during urethroplasty. However, in long-segment stricture, there might be an increased risk of damage to this neural

mechanism during dissection due to severe inflammation and fibrosis which can explain SD after DBMGU. Refined surgical techniques can resolve it.

Although it was a prospective study, there are few limitations present in our study. It includes lacking proper preoperative sexual function assessment which was done mainly with the help of subjective parameters, i.e. IIEF questionnaire instead of objective parameters (e.g. blood for testosterone level, prolactin, thyroid function test, serum prostate-specific antigen, radiologic evaluation for vascular etiology, and neurological assessment). Hence, the chance of recall bias was there in preoperative data collection as patients filled up the questionnaire by recapitulating their day-to-day sexual life. A larger patient population, multicenter studies, and assessment of preoperative objective parameters may provide better insight into this matter.

CONCLUSION

From our study, we can state that the incidence of SD after urethroplasty is nearly 24%, but the type of surgical technique itself does not significantly affect sexual function. Rather, age is proved to be the sole independent predictor of *de novo* SD after urethroplasty, when we consider all other factors at the same time. Although SD is inevitable in certain groups of patients, fortunately, it is transient in nature which gradually improves with time being, mostly by 6 months. Furthermore, in older patients, it may take a longer time than younger patients. Hence, overall, urethroplasty remains the gold standard treatment of USD in terms of surgical success and outcome.

Acknowledgments

We would like to thank Dr. Bandhan Bahal and Dr. Prashant Gupta, MCh residents of the Department of Urology, Calcutta National Medical College and Hospital.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Blaschko SD, Sanford MT, Cinman NM, McAninch JW, Breyer BN. *De novo* erectile dysfunction after anterior urethroplasty: A systematic review and meta-analysis. *BJU Int* 2013;112:655-63.
2. Haines T, Rourke K. The effect of urethral transection on erectile function after anterior urethroplasty. *World Journal of Urology*. 2016;35:839-45.
3. Mundy AR. Results and complications of urethroplasty and its future. *Br J Urol* 1993;71:322-5.

4. Rosen RC, Cappelleri JC, Smith MD, Lipsky J, Peña BM. Development and evaluation of an abridged, 5-item version of the international index of erectile function (IIEF-5) as a diagnostic tool for erectile dysfunction. *Int J Impot Res* 1999;11:319-26.
5. Kulkarni S, Barbagli G, Sansalone S, Lazzeri M. One-sided anterior urethroplasty: A new dorsal onlay graft technique. *BJU Int* 2009;104:1150-5.
6. Rosen RC, Riley A, Wagner G, Osterloh IH, Kirkpatrick J, Mishra A. The international index of erectile function (IIEF): A multidimensional scale for assessment of erectile dysfunction. *Urology* 1997;49:822-30.
7. Woodward JM, Hass SL, Woodward PJ. Reliability and validity of the Sexual Life Quality Questionnaire (SLQQ). *Qual Life Res* 2002;11:365-77.
8. Erickson BA, Wysock JS, McVary KT, Gonzalez CM. Erectile function, sexual drive, and ejaculatory function after reconstructive surgery for anterior urethral stricture disease. *BJU Int* 2007;99:607-11.
9. Johannes CB, Araujo AB, Feldman HA, Derby CA, Kleinman KP, McKinlay JB. Incidence of erectile dysfunction in men 40 to 69 years old: Longitudinal results from the Massachusetts male aging study. *J Urol* 2000;163:460-3.
10. Haines T, Rourke KF. The effect of urethral transection on erectile function after anterior urethroplasty. *World J Urol* 2017;35:839-45.
11. Johnson EK, Latini JM. The impact of urethroplasty on voiding symptoms and sexual function. *Urology* 2011;78:198-201.
12. Xie H, Xu YM, Xu XL, Sa YL, Wu DL, Zhang XC. Evaluation of erectile function after urethral reconstruction: A prospective study. *Asian J Androl* 2009;11:209-14.
13. Dogra PN, Saini AK, Seth A. Erectile dysfunction after anterior urethroplasty: A prospective analysis of incidence and probability of recovery-single-center experience. *Urology* 2011;78:78-81.
14. Erickson BA, Granieri MA, Meeks JJ, Cashy JP, Gonzalez CM. Prospective analysis of erectile dysfunction after anterior urethroplasty: Incidence and recovery of function. *J Urol* 2010;183:657-61.
15. Dogra PN, Singh P, Nayyar R, Yadav S. Sexual dysfunction after urethroplasty. *Urol Clin North Am* 2017;44:49-56.
16. Blaschko SD, Sanford MT, Schlomer BJ, Alwaal A, Yang G, Villalta JD, *et al.* The incidence of erectile dysfunction after pelvic fracture urethral injury: A systematic review and meta-analysis. *Arab J Urol* 2015;13:68-74.
17. Coursey JW, Morey AF, McAninch JW, Summerton DJ, Secret C, White P, *et al.* Erectile function after anterior urethroplasty. *J Urol* 2001;166:2273-6.
18. Al-Qudah HS, Santucci RA. Extended complications of urethroplasty. *Int Braz J Urol* 2005;31:315-23.
19. Eltahawy EA, Virasoro R, Schlossberg SM, McCammon KA, Jordan GH. Long-term followup for excision and primary anastomosis for anterior urethral strictures. *J Urol* 2007;177:1803-6.
20. Santucci RA, Mario LA, McAninch JW. Anastomotic urethroplasty for bulbar urethral stricture: Analysis of 168 patients. *J Urol* 2002;167:1715-9.
21. Palminteri E, Manzoni G, Berdondini E, Di Fiore F, Testa G, Poluzzi M, *et al.* Combined dorsal plus ventral double buccal mucosa graft in bulbar urethral reconstruction. *Eur Urol* 2008;53:81-9.
22. Kessler TM, Fisch M, Heitz M, Olianias R, Schreiter F. Patient satisfaction with the outcome of surgery for urethral stricture. *J Urol* 2002;167:2507-11.
23. Anger JT, Sherman ND. The effect of bulbar urethroplasty on erectile function. *J Urol* 2001;178:1009-11.
24. Shenfeld OZ, Kiselgorf D, Gofrit ON, Verstandig AG, Landau EH, Pode D, *et al.* The incidence and causes of erectile dysfunction after pelvic fractures associated with posterior urethral disruption. *J Urol* 2003;169:2173-6.
25. Nelson CP, Bloom DA, Kinast R, Wei JT, Park JM. Patient-reported sexual function after oral mucosa graft urethroplasty for hypospadias. *Urology* 2005;66:1086-9.
26. Singh UP, Maheshwari R, Kumar V, Srivastava A, Kapoor R. Impact on sexual function after reconstructive surgery for anterior urethral stricture disease. *Indian J Urol* 2010;26:188-92.
27. Lue TF, Zeineh SJ, Schmidt RA, Tanagho EA. Neuroanatomy of penile erection: Its relevance to iatrogenic impotence. *J Urol* 1984;131:273-80.