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Outcome of dorsal versus ventral onlay buccal mucosa graft urethroplasty in female urethral stricture

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Abstract
Female urethral stricture (FUS) yet one that can cause significant bothersome lower urinary tract symptoms (LUTS) represents an uncommon condition. A variety of reconstructive surgical techniques have been described in recent years to provide more definitive in this challenging group.

Aim of the study: The aim of this study was to find out the outcome of dorsal and ventral onlay buccal mucosa graft (BMG) urethroplasty in female urethral stricture disease.

Methods: This Quasi experimental study was conducted in the Department of Urology, Dhaka Medical College Hospital Dhaka during the period from July, 2018 to June, 2020. Total 30 patients with moderate to severe bothersome LUTS due to mid and/or distal urethral stricture were included in the study as per inclusion and exclusion criteria. Patients were divided into two groups. Group-A for dorsal onlay and Group-B for ventral onlay buccal mucosa graft urethroplasty to every alternate sequence. All women were evaluated preoperatively, as per predefined criteria. As failure of the treatment, increase in AUA symptom score, maximum flow rate (Qmax) <12 ml/s, and failure to calibrate with 18 Fr catheter needs subsequent intervention were considered.

Results: The mean age of the patients in Group-A was 45.86 (range, 25-58) years and Group-B was 48.26 (range, 38-60) years. Majority of the women 16(53.33%) had strictures located combined at mid and distal urethra. There were significant improvements in AUA symptom score and maximum urinary flow rate (Qmax) and reduction in post void residue (PVR) ($p<0.001$) at 1, 3 and 6 months follow-up in both groups. In Group-B, postoperative complication rate was 53.3% and none of the patient in Group-A developed any postoperative complication ($p= 0.002$). In Group-A, 13(86.67%) women and in Group-B 12 (80%) women voided successfully after removal of catheter.

Conclusion: Both dorsal and ventral onlay buccal mucosa graft urethroplasty in the treatment of female urethral stricture provides significant improvement in patient symptoms and urinary flow but postoperative complications are higher in ventral onlay technique.

Keywords: onlay, urethral stricture, ventral onlay

Introduction

Female urethral stricture (FUS) is a relatively uncommon condition but it can cause bothersome lower urinary tract symptoms (LUTS). Of women with LUTS, it has been estimated that bladder outflow obstruction (BOO) accounts for between 2.7% and 8% [1, 2]. FUS accounts for between 4% and 18% of these cases, in women with known BOO [3, 4]. Because of its uncommon presentation, and strict diagnostic criteria have not been documented. Difficulty in placing a catheter larger than 12 Fr is suggestive. However, it was stated that a detrusor pressure of 25 cm of water and maximum urinary flow rate of less than 12 ml/s is consistent with obstruction [5] Similar to men, stricture disease is often treated with repeated urethral dilation or urethrotomy. These procedures are uncomfortable and require multiple office visits and occasionally urgent visits to the emergency room for acute retention. The squeals of inadequate treated stricture disease are recurrent urinary tract infections, symptoms of urgency, frequency and rarely uraemia due to chronic retention. Due to bleeding and extravasations, surgical repair of the stricture offers effective and durable results in women with recurrent stricture disease in whom that the conservative management is failing. And it should be considered an earlier intervention rather than a last resort reported that results of repeated urethral dilatations and urethrotomies are not good in females as subsequent fibrosis occurs [6, 7] An analysis of national data sets indicates that the number of office visits for female urethral stricture exceeds the diagnosis of true urethral stricture [8]. This suggests that patients are being over treated with urethral dilations for LUTS in the absence of documented BOO. Traditionally female urethral stricture has been managed using endoscopic techniques with or without intermittent self-

catheterization (ISC). Unfortunately, endoscopic techniques have high recurrence rates [9, 10]. The initial management of female urethral strictures has remained controversial. Various data recommend dilation and urethrotomy for short urethral strictures, albeit high recurrence rates. Currently, the buccal mucosa graft (BMG) is the preferred donor site for substitution urethroplasty [11]. The use of buccal mucosa graft (BMG) for urethral reconstruction was first described by Humby in 1941 [12]. After having the sleeping beauty for more than 5 decade buccal mucosa graft urethroplasty experienced its renaissance after rediscovered this technique in the early 1990s [13]. The buccal mucosa graft is composed of thick epithelium, thin lamina propria and rich vascular supply facilitating early inosculation. The graft is resistant to infection, easy to harvest, a hidden donor site and has no hair follicle [14]. The success rates of various procedures have also been poorly described in the literature. The problem is the interpretation of results includes small number of patients, short follow-up durations and mixed type of procedures. However, in most series the results shown have been generally good [15, 16]. Many studies have been reported in different part of the world to see the outcomes of dorsal versus ventral onlay buccal mucosa graft urethroplasty in female urethral stricture. However, there is no such published study has been found in the perspective of our country. There are also very limited studies comparing dorsal versus ventral buccal mucosa graft (BGM) urethroplasty in the treatment of female urethral stricture. The object of my study is to evaluate the outcome of women undergoing urethral reconstruction with either dorsal onlay or ventral onlay buccal mucosa graft at our institution and to standardize a better treatment option for female urethral stricture.

Objectives

General objective

To see the outcome of dorsal and ventral onlay buccal mucosa graft urethroplasty in the treatment of female urethral stricture disease.

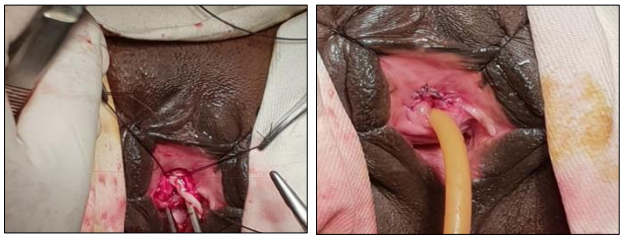
Specific objective

- To compare the maximum urinary flow (Qmax) before and after urethroplasty
- To assess the success of dorsal and ventral onlay buccal mucosa graft urethroplasty
- To see the post-operative complications of dorsal and ventral onlay urethroplasty procedures-Urethro-vaginal fistula, stress urinary incontinence

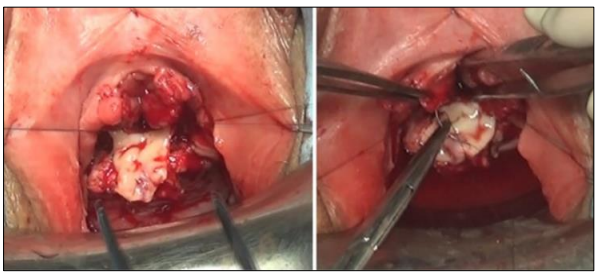
Materials and Methods

This was a prospective quasi experimental study, conducted in the Department of Urology, Dhaka Medical College Hospital Dhaka, Bangladesh from July, 2018 to June, 2020. A total 30 women who were admitted for the management of urethral stricture disease of three month after urethral dilation or otis urethrotomy had been selected as study population. A purposive sampling method was followed for sample selection. The ethical clearance was taken from the Ethical Board of Dhaka Medical College, Dhaka.

A written informed consent paper taken from the partisans. Patient with traumatic and post radiation stricture urethra, complex stricture requiring multistage urethroplasty, with history of urethral and urinary bladder malignancy, genital sclerosis, neurogenic bladder dysfunction, leukoplakia, sub mucosal fibrosis or malignancy of oral cavity, previous oral surgery, had excluded from this study. Patients were divided in to two groups for Group-A, of dorsal onlay BMG urethroplasty and Group-B of ventral onlay BMG urethroplasty. Each patient was evaluated by history, physical examinations and investigations. All participants with LUTS were categorized using the AUA symptom score. Histories were taken about trauma, per urethral instrumentations, urinary tract infection and DM. Physical examination included general examination and examination of renal region and other part of genitourinary system to exclude other causes of LUTS. All patients were investigated properly by-urine for routine & microscopic examination to identify urinary tract infection. Serum creatinine were done to assess renal function. Ultrasonogram of KUB region with MCC and PVR (ml) were done to see post void residue and any change in upper tract. Uroflowmetry were done to see Qmax and flow time. Voiding cystourethrograms were done to see dilation of proximal urethra, Other routine investigation were done for anesthetic fitness, such as complete blood count, random blood sugar (RBS), electrolytes, X-ray chest, ECG and ecocardiogram in selective cases. The diagnosis of urethral stricture was made from the collective finding of clinical assessment, uroflowmetry (Qmax <12ml) with significant PVR (>90ml), narrowing of urethra with proximal dilation on voiding cystourethrogram and inability to calibrate the urethra with 14 Fr catheter. Women with neurogenic voiding dysfunction, genital sclerosis, post radiation and patients who did not give consent were excluded from the study. None of the patients had preoperative incontinence and all patients had normal urine examination and serum creatinine preoperatively.



Picture 1: (a) Dorsal onlay placement of buccal mucosa graft (b) Dorsal onlay buccal mucosal graft urethroplasty with catheter.



Picture 2: (a) And (b) Ventral onlay placement of buccal mucosa graft

Results

Table 1: Distribution of the patients according to age in groups (N=30)

Age (years)	Group A (Dorsal onlay BMGU) (n=15)	Group B (Ventral onlay BMGU) (n=15)	p-Value
≤ 40 yrs.	6(40.0)	3(20.0)	
41 - 50 yrs.	5(33.3)	6(40.0)	
51 - 60 yrs.	4(26.7)	6(40.0)	
Mean ± SD	45.86 ± 10.04	48.26 ± 7.25	0.460
Range	25 - 58	38 - 60	

Table I showed, majority 21(70%) of the patients in both groups were in age range 41-60 years. Out of 15 cases in each group 6(40%) patients in Group-A (dorsal only BMGU) and 3(20%) patients in Group-B (ventral onlay BMGU) were found below the age of 40 years. Mean ± SD age in Group-A was 45.86 ±10.04 (range, 25-58 years) and in Group-B was 48.26 ± 7.25 (range, 38-60 years). The groups were not statistically different in terms of age (p=0.460).

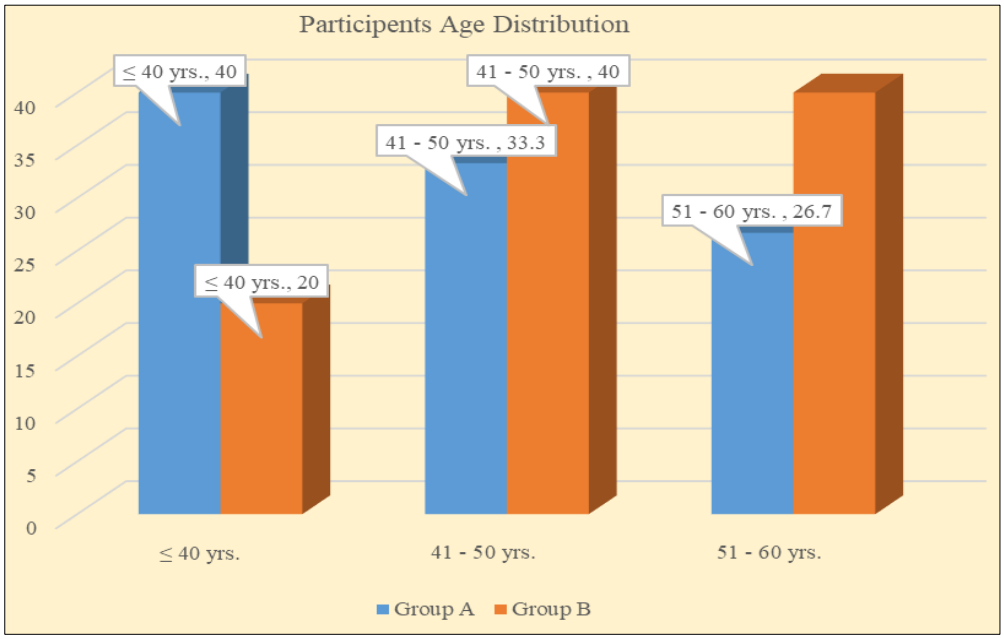


Fig 1: Participants Age Distribution

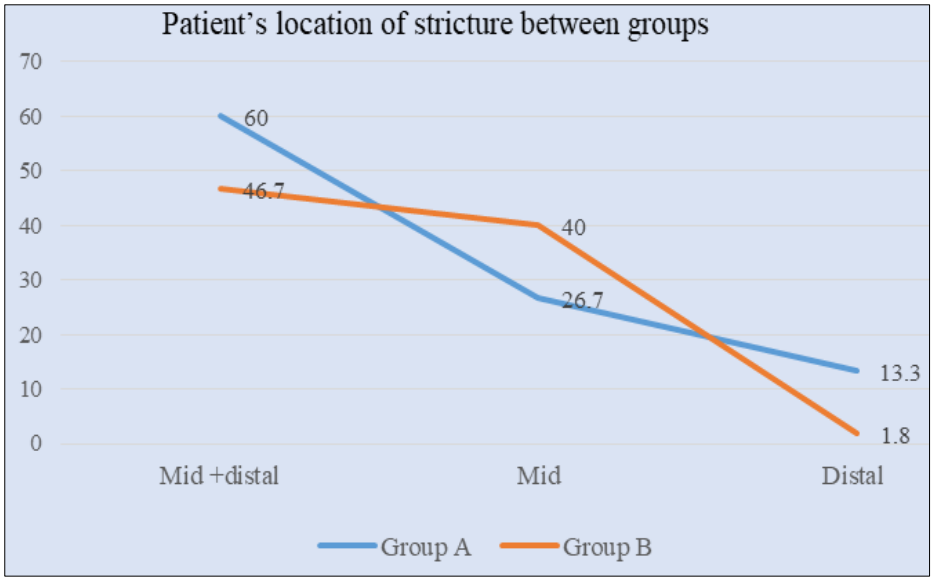


Fig 2: Distribution of the patient's location of stricture between groups

Table 2: Stricture length of the patients between groups (N=30)

Stricture length (cm)	Group A (Dorsal onlay BMGU) (n=15)	Group B (Ventral onlay BMGU) (n=15)	p-Value
<2 cm	7(46.7)	10(66.7)	
2- 3 cm	8(53.3)	5(33.3)	
Mean ± SD	1.82 ± 0.67	1.80 ± 0.62	0.955
Range	0.5-2.75	1.00-3.00	

Table 2 showed, 15 patients of Group-A (dorsal onlay BMGU) undergoing reconstruction for stricture, length was <2 cm in 7(46.7%) patients and 2-3 cm in 8(53.3%) patients. In Group-B (ventral onlay BMGU) patients length was <2 cm in 10(66.7%) patients and 2-3 cm in 5(33.3%) patients. Mean ± SD stricture length in Group-A was 1.82 ± 0.67 cm and Group-B was 1.80 ± 0.62 cm. No significant difference was observed between groups in terms of stricture length (p=0.955)

Table 3: Pre and post-operative AUA symptom score between groups (N=30)

AUA symptom score	Group A (Dorsal onlay BMGU) (n=15)	Group B (Ventral onlay BMGU) (n=15)	p-Value
Preoperative	27.60 ± 4.53	28.40 ± 5.10	0.653
After 1 month	7.33 ± 1.84	7.27 ± 1.79	0.921
After 3 months	6.20 ± 1.47	7.13 ± 1.85	0.137
After 6 months	7.00 ± 1.65	6.53 ± 1.13	0.373
	Preoperative	Postoperative (after 6 month)	
Group A	27.60±4.53	7.00 ± 1.65	<0.001
Group B	28.40 ± 5.10	6.53±1.13	[b]<0.001

Table 3 showed the mean ± SD AUA symptom score was 27.60 ± 4.53 in Group-A (darsal onlay BMGU) and 28.40 ± 5.10 in Group-B (ventral onlay BMGU). Following reconstruction in Group-A and Group-B after 1, 3 and 6 months post-operatively mean AUA symptom score were significantly improved (p< 0.001).

Table 4: Pre and post-operative post void residue between groups (N=30)

PVR (ml)	Group A (Dorsal onlay BMGU) (n=15)	Group B (Ventral onlay BMGU) (n=15)	p-Value
Preoperative	163.13 ± 60.38	110.13 ± 36.34	[a]0.007
After 1 month	15.37 ± 6.15	11.79 ± 4.42	[a]0.085
After 3 months	14.53 ± 3.85	13.93 ± 5.21	[a]0.724
After 6 months	14.73 ± 4.03	12.50 ± 6.29	[a]0.289
	Preoperative	Postoperative(after 6 month)	
Group A	163.13 ± 60.38	14.73 ± 4.03	[b]<0.001
Group B	110.13 ± 36.34	12.50 ± 6.29	[b]<0.001

Table 4 showed, preoperative mean post void residue (PVR) in Group-A (dorsal onlay BMGU) was 163.13 ± 60.3 and in Group-B (ventral onlay BMGU) was 110.13 ± 36.34 ml which improved significantly after 1, 3 and 6 months postoperatively in both groups (p<0.001).

Table 5: Pre and post-operative maximum urinary flow rate (Qmax) between groups (N=30)

Qmax (ml/s)	Group A (Dorsal onlay BMGU) (n=15)	Group B (Ventral onlay BMGU) (n=15)	p-Value
Preoperative	5.77 ± 2.37	6.31 ± 2.69	[a]0.565
After 1 month	17.11 ± 2.63	16.83 ± 2.60	[a]0.770
After 3 months	18.65 ± 2.60	17.99 ± 2.47	[a]0.482
After 6 months	18.80 ± 1.96	18.61 ± 2.51	[a]0.822
	Preoperative	Post-operative (after 6 month)	
Group A	5.77± 2.37	18.80 ± 1.96	b<0.001
Group B	6.31 ± 2.69	18.61 ± 2.51	b<0.001

Table 5 showed, preoperative mean ± SD Qmax was 5.77 ± 2.37 ml/s and 6.31 ± 2.69 ml/s in Group-A (dorsal onlay BMGU) and Group-B (ventral onlay BMGU) respectively and after 1, 3 and 6 months following reconstruction showed significant improvements in Qmax (p<0.001).

Table 6 Success of dorsal and ventral buccal mucosa graft urethroplasty procedures (N=30)

Success of urethroplasty	Group A (Dorsal onlay BMGU) (n=15)	Group B (Ventral onlay BMGU) (n=15)	p-Value
After 6 months	13 (86.67)	12 (80.0)	1.000

Table 6 showed, in Group-A (dorsal onlay BMGU), 2 (13.3%) patients and in Group-B (ventral onlay BMGU), 3 (20.0%)

patients were developed recurrence of stricture after 6 months postoperatively. The success rate after urethral reconstruction was 86.67% and 80% in Group-A and Group-B respectively. So, the success rates were almost similar in both groups (p = 1.000).

Table 7: Post-operative complications of dorsal and ventral onlay buccal mucosa graft urethroplasty (N=30)

	Group A (Dorsal onlay BMGU) (n=15)	Group B (Ventral onlay BMGU) (n=15)	p-Value
Urethro-vaginal fistula	0 (0.0)	4 (26.67)	0.1
Stress incontinence	0 (0.0)	4 (26.67)	0.1
Total	0	8 (53.34)	0.002

Table 7showed, in Group-A, none of the patient developed urethro-vaginal fistula and stress urinary incontinence postoperatively but in Group-B, 4(26.67%) patients developed urethro-vaginal fistula 3(20.0%) and 1(6.67%) after 1 month and 3 month respectively and 4(26.67%) patients also developed stress urinary incontinence postoperatively 2(13.3%) patients at 1 month and 2(13.3%) patients at 3 month respectively. Total 8(53.34%) patients in Group-B (ventral onlay BMGU) developed post-operative complications and results were statistically significant (p= 0.002).

Discussion

Female bladder outlet obstruction (BOO), an uncommon clinical entity constitutes approximately 3-8% of women presenting with LUTS. Female urethral stricture accounts for about 2.7-8% of women diagnosed with BOO. Urethral stricture disease in females can cause voiding as in male patients and storage LUTS, recurrent urinary tract infections, and even renal impairment. These symptoms are usually of long duration and severe which causes significant impairment in quality of life. Although it seems to occur most commonly in mid and distal urethra and less in proximal urethra, stricture is usually distal to external urethral sphincter and can occur in any part of urethra. There are no strict subjective and objective criteria for defining female urethral stricture date. Therefore, the AUA symptoms score was used as a subjective tool for assessment of symptoms, while maximum urinary flow rate and post void residue estimation were used for objective evaluation. There is no unanimity as regards the standard treatment modality. A variety of treatment options are available ranging from minimal invasive procedure like urethral dilation and various surgical reconstructive procedures include vaginal and labial flaps or oral grafts which can be placed via a ventral, dorsal, or circumferential approach being an uncommon clinical entity. Unfortunately most of the published data are from small series and often includes various techniques for reconstruction. With difficulty assessing outcomes of any single approach, this leads to heterogeneity of outcomes data. Buccal mucosa has been extensively used as graft in male urethroplasty because of easy availability, easy harvesting, and excellent physical, vesicoelastic properties and vascular characteristics. Bergland *et al*. (2006) and Gozzi *et al*. (2011) [17, 18]. Described the use of free buccal mucosa graft through ventral. The volume of refractory recurrent female urethral stricture disease is low and the techniques used to be refined, and this makes it difficult to produce high-quality studies. A study done by Osman *et al*. (2015). No consensus currently exists as to which of the substitution urethroplasty techniques offers the optimum outcomes described [19]. With difficulty assessing outcomes of any single approach, this leads to heterogeneity of outcomes data. The present study has been designed to compare the outcome of dorsal and ventral onlay buccal mucosa graft urethroplasty in the management of female urethral stricture disease. Patients with stricture disease undergone urethroplasty were divided into 2 groups. Patients belonging Group-A were managed by dorsal onlay buccal mucosa graft and patients belonging Group-B were managed by ventral onlay baccal mucosa graft urethroplasty. Results of treatment of both groups were compiled and compared. The AUA symptoms score, post void residue, maximum urinary flow rate, success of both procedures, stress urinary incontinence and urethro-vaginal fistula were compared as outcome variables between groups. Age ranges of the patients in present study were between 25 and 60 years. Majority 21(70%) of the patient in both groups were in age range 41-60 years. Out of 15 cases in each group 6(40%) patients in Group-A and 3(20%) patients in Group-B were below the age of 40. The age range of the present study more or less comparable with the study done by Sing *et al*. (2013); Hampson *et al*. (2019)[19,20] to evaluate the outcome of dorsal only buccal mucosa graft urethroplasty in 3, 16, 8 and 39 patients respectively. Stricture location was another baseline variable. A majority of the women 9(60%) in group-A and 7(46.7%) patients in Group-B had combined stricture at mid and distal urethral region and 4(26.7%) and 6(40%) were at mid urethra respectively. Only 2(13.3%) were at distal urethra in both groups. Most of the women 17(56.67%) patients stricture length were below 2 cm and 8(53.3%) patients in Group-A and 5(33.33) patients in group-B were between 2 and 3 cm. Mean ± SD stricture length was 1.82 ± 0.67cm and 1.80 ± 0.62 cm in Group-A and Group-B respectively. In the present study postoperative mean post void residue (PVR) of both groups were compared. There were significant decreases of PVR in both groups (p< 0.001) during follow-up. Mean maximum urinary flow rates in this study were evaluated preoperative and postoperatively in both groups and observed significant improvement (p<0.001). Ozlulerden *et al*. (2020) [21] also seen similar result following ventral onlay buccal mucosa graft urethroplasty from mean Qmax 5.1(3.2-9.5) ml/s to 31.8(24.7-36.2) ml/s at 3rd month follow-up. Group-A patients who undergone dorsal onlay buccal mucosa graft urethroplasty did not developed urethro-vaginal fistula but 4 patients (26.67%) in Group-B who undergone ventral buccal mucosa graft urethroplasty developed urethro-vaginal fistula. In this study causes of urethro-vaginal fistula in Group- B were may be due to old age associated with atrophy of vaginal wall, poor vascularitiy and overlying suture line and not using additional flap to support the vaginal wall. Of them 1 was repaired with Martius flap, 2 are waiting for repair and 1 more distal site unwilling to do further surgery. They showed that possible injury to the neurovascular bundles of clitoris is avoidable, as they are quite far from the dissection area and striated urogenital sphincter in the dorsal approach is preserved by reflecting it upward. On the dorsal aspect, the urethra is only juxtaposed to the clitoral

structure, which is carefully preserved during dissection has no theoretically possible complications such as vestibular deformation or urethro-vaginal fistula. Patients with dorsal onlay buccal mucosa graft urethroplasty did not developed any de novo stress urinary incontinence but patients with ventral onlay buccal mucosa graft urethroplasty 4(26.67%) patients developed stress urinary incontinence which improved over time with conservative management. Factors behind the stress urinary incontinence may be due to lack of deficiency of striated sphincter ventrally with loss of support of urethra by cutting the anterior vaginal wall ventrally. Colleselli *et al*. (1998) [22] described the ventral onlay grafting include the lower risk of new onset stress urinary incontinence with ventral incision because of the horseshoe shape of the female urethral sphincter with its ventral deficiency. Though the fear of injuring the urethral sphincter mechanism, the incidence of developing stress urinary incontinence was very low after either dorsal or ventral approach described by Nayak *et al*. (2019) [23] This was verified in the present study in which only 4(26.67%) women developed stress urinary incontinence after ventral onlay urethroplasty which were mild and self-limiting. Total 8(53.34%) women in Group-B developed postoperative complications and none of the patient in Group-A developed any complication during the follow-up (p=0.002). In Group-A, 2(13.3%) women and in Group-B, 3 (20%) women reported recurrence at 6 months follow-up. In the present study, Group-A patient's success rate was 86.67% and Group-B patient's was 80%. Overall combined success rate was 83.33%. Urethrocystoscopy showed stricture just proximal to reconstruction in one patient and disease recurrence in two patients which were subsequently improved by dilation. In present study, there were no preoperative factors that significantly predicted recurrence, although those with recurrence had a slightly longer mean stricture length and postulated that repeated endoscopic procedures would impact urethral reconstruction and prevented assessment of this risk factor. The reason for failure in the present study could be underestimate the length of stricture for fear of proximal dissection to avoid jeopardizing the urethral sphincter mechanism, progressive nature of the disease as noticed recurrence above the grafted urethra, or poor vascularise of the graft bed. Other series have reported outcomes of dorsal onlay BMGU in female urethral stricture with 62.5% to 100% success rate and mean follow-up of ranging from 6-30 months. Stricture free survival was achieved in 21 out of 22(95.5%) women at a median follow-up of 21.5 months following ventral onlay buccal mucosa graft urethroplasty observed by Onol *et al*. (2011) [24] also reported 100% stricture free rate following ventral onlay buccal mucosa graft urethroplasty in female urethral stricture disease.

Conclusion

Both dorsal and ventral onlay buccal mucosa graft urethroplasty in female urethral stricture provides significant improvement in patient's symptoms and urinary flow but postoperative complications are higher in ventral onlay technique.

Limitations of this study

The sample size in each group was relatively small. So, findings in this study mightnot be generalized in large scale. Though the sampling was purposive, data might have some brassiness. Due to short follow-up period, long term outcome could not be evaluated. It was a single center study. Variation in outcome in other hospitals could not be compared. Confounding factors were not evaluated like; DM and support of urethra by Martus flap in ventral onlay technique. Urodynamic study was not done to evaluate neurogenic bladder.

Recommendations

According to the findings of the present study it can be said that both dorsal and ventral onlay buccal mucosa graft urethroplasty techniques are effective and can be practiced in the management of female urethral stricture with a lower postoperative complications. Further study with more patients and longer follow-up is required to establish which treatment approach provides consistent superior outcomes.

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