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IUJ VIDEO

Ventral-onlay buccal mucosal graft urethroplasty for the treatment of female urethral stricture: a step-by-step video for Female Pelvic Reconstructive Surgeons

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Abstract

Introduction and hypothesis Female urethral stricture is a relatively uncommon disease. Conservative management with repeated urethral dilation often leads to unsatisfactory results. Although treatment of female urethral stricture with urethral reconstruction using a variety of surgical techniques is a surgical option, female pelvic reconstructive surgeons have limited exposure to these procedures in their training. The purpose of this video is to demonstrate a step-by-step ventral-onlay buccal mucosal graft urethroplasty in a patient with female urethral stricture disease.

Methods We use a live action surgical video to describe the harvest of a buccal mucosal graft and ventral-onlay urethroplasty.

Results This video provides a step-by-step approach to a ventral urethroplasty using a buccal mucosal graft. It can be used to educate and train those performing female pelvic reconstructive surgery.

Conclusion Pelvic surgeons should be familiar with the management of female urethral stricture, including surgical treatment options such as urethral reconstruction. This video may be used to facilitate the reproducibility and comprehension of the ventral urethroplasty procedure.

Keywords Female urethral stricture · Buccal mucosal graft · Urethroplasty · Surgical video

Introduction

Female urethral stricture (FUS) is one of several entities included in female bladder outlet obstruction (BOO). BOO affects about 3–8% of women and the incidence of FUS within this population is reported to be between 4% and 13% [1, 2]. Although usually unknown, the etiologies of FUS include infection, iatrogenic injury, malignancy, a history of urethral surgery or pelvic irradiation, and trauma [1–5]. Women with FUS typically present with lower urinary tract symptoms such as frequency, urgency, hesitancy, weak stream, postmicturition dribble, mixed incontinence, and may complain of hematuria, dysuria, and recurrent urinary tract infections. There is no internationally accepted definition of FUS and its diagnosis remains challenging and controversial. A systematic review of the FUS literature described it as "a symptomatic, anatomical narrowing of the urethra based on a failure of catheterization, urethral calibration, visual inspection, or endoscopy or radiography" [2]. Diagnosis is often made using a combination of history, physical examination, uroflowmetry with post-void residual (PVR) urine estimation, urethroscopy, voiding cystourethrography (VCUG), and depending on stricture location, retrograde urethrography. Although not essential to the diagnosis, if the stricture can be bypassed with a small catheter or if there is suprapubic access, (video)-urodynamics can be performed.

Management of FUS often begins with urethral dilation, with the goal of relieving obstruction and its associated symptoms while preserving continence [1, 2]. For patients experiencing inadequate symptom resolution with

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conservative management, there are a variety of surgical options. Several reconstructive techniques have been described, including meatotomy and meatoplasty for distal strictures, urethroplasty using vaginal and labial flaps, and urethroplasty using vaginal and oral mucosal grafts [2, 5]. Urethroplasties may be performed using a ventral-onlay, inlay, or dorsal-onlay approach. The ventral approach requires minimal urethral mobilization, but carries a greater risk of urethrovaginal fistula [2, 6–8]. The dorsal approach offers a well-vascularized graft bed and mechanical support through the clitoral cavernosal tissue, but there is a higher risk of injury to the urethral sphincter and neurovascular supply to the clitoris. No long-term data exist to show superiority with either the dorsal or the ventral technique, and the decision is usually made based on surgeon preference.

Buccal mucosa harvest is a well-tolerated technique that is utilized in the setting of vaginal atrophy, previous urogenital surgery, and/or pelvic radiation [2, 6]. In a recent systematic review of surgical approaches to FUS, augmentation urethroplasty using buccal mucosal grafts has the highest success rate for urethroplasty for FUS at 94% compared with 91% with a vaginal/labial flap and 80% with a vaginal/labial graft [2]. However, this same study reported that buccal mucosal graft surgical outcomes also have the shortest follow-up period of the techniques studied and further investigation of this procedure will help pelvic surgeons to assess the longevity of this surgical option [2].

The purpose of this video is to demonstrate the harvest of a buccal mucosal graft and its use in ventral urethral reconstruction in a patient with FUS of unknown etiology. The patient in this video complained of difficulty emptying her bladder and symptoms of urinary frequency with occasional urge urinary incontinence. She had a history of urinary retention and a weak urinary stream. Her preoperative PVR was 122 mL. She was diagnosed with FUS after difficult catheterization requiring multiple urethral dilations. She was unable to accommodate office cystoscopy. A VCUG demonstrated a dilated bladder neck and a trabeculated bladder with multiple diverticula consistent with BOO. Using live footage and step-by-step instructions, this video can serve as an educational tool for female pelvic reconstructive surgeons at all levels.

Materials and methods

This video demonstrates the harvest of a buccal mucosal graft and its use in a ventral-onlay urethral reconstruction using live footage from the operating room. The following steps are key to successfully performing the procedure and are highlighted in the video:

- Step 1: delineation of urethral anatomy, hydrodissection, and development of an inverted U flap. Patient is placed in high dorsal lithotomy position. A Lone-Star self-retaining retractor (Cooper Surgical) is used to facilitate visualization. A 14-Fr Foley catheter is introduced into the bladder. An inverted U is demarcated from the urethral meatus to the bladder neck. This flap is then hydrodissected using 1% lidocaine HCL with epinephrine 1:100,000. An incision is made using a 15-blade scalpel and an inverted U flap is created using sharp dissection to the level of the bladder neck. A full-thickness vaginal dissection is performed to minimize the risk of a urethrovaginal fistula.
- Step 2: initial urethral calibration with a bougie a boule. A 22-Fr bougie a boule is used to calibrate the urethra and identify the level of the stricture.
- Step 3: development of a periurethral flap. A flap of periurethral tissue is carefully developed separate from the previously created U-flap of vaginal tissue. This flap is used to cover the graft to help prevent the development of urethrovaginal fistulae postoperatively.
- Step 4: clean-up. Redundant periurethral tissue is excised to prepare fresh margins for the anastomosis.
- Step 5: re-calibration. Calibration is performed again as we believe in the principle of "measure twice, cut once." The 22-Fr bougie a boule is used again to confirm the location of the stricture. This is a precautionary step performed to ensure that the surgeon is cognizant of the location of the stricture. A suprapubic catheter (SPC) is inserted for temporary urinary diversion prior to the urethrotomy under cystoscopic guidance (not shown). Alternatively, the SPC can be inserted during step 6.
- Step 6: ventral urethrotomy and fine-tuned calibration. Using Metzenbaum scissors, a ventral urethrotomy is created from the urethral meatus to just beyond the proximal aspect of the stricture. The bougie a boule is used throughout the dissection to ensure that the urethrotomy is extended as proximal as necessary to allow for a large-diameter anastomosis while preserving sphincteric function. Cystoscopic examination is performed to confirm that the sphincter remains uninjured and that the remaining urethral mucosa appears healthy. The process of extending the urethrotomy followed by cystoscopic examination may be repeated as necessary until the urethrotomy is fully developed. Once complete, a ruler is used to measure the distance from the urethral meatus to the proximal margin. In the present case, this distance was 2.5 cm. Please note that if the stricture extends beyond the sphincter, the urethrotomy is continued beyond the sphincter to allow for adequate stricture repair. In this scenario, it is imperative to counsel the patient that they are at an increased risk for stress urinary incontinence postoperatively.
- Step 7: harvest of the buccal mucosal graft. Retraction sutures are placed through the lip. Stensen's duct, for drainage of the parotid gland, is identified at the upper second molar and care is taken to avoid injury to the duct.

For this case, a 3 cm × 2 cm ellipsoid area was demarcated using a marking pen. Hydrodissection is performed using 1% lidocaine HCl with 1:100,000 epinephrine. An incision is made using a scalpel and the graft is dissected sharply in a circumferential fashion, taking care to leave behind the underlying fat and muscle. The graft harvest length is the length of the urethrotomy. The standard width is 2–2.5 cm based on the health of the native urethral tissue.

- Step 8: graft maturation. The graft is matured by removing excess fat and muscular tissue to allow for improved graft uptake.
- Step 9: anastomosis between the urethrotomy and the graft. The bougie a boule is placed to assist in the identification of the proximal level of the urethrotomy as the final calibration. The anastomosis is performed using 5–0 Vicryl sutures. Three 5–0 Vicryl sutures are placed through the proximal aspect of the urethrotomy. During this time, the vacuum suction is clamped to prevent inadvertent suctioning of the buccal graft. The graft is then placed with the mucosal surface facing the flow of urine. Note that the urethral stitches (as described in the video) are placed in an outside-in fashion, whereas the graft stitches are placed inside-out on the graft, thereby allowing the knot to lay on the external surface of the urethra. Interrupted lateral stitches are placed to attach the graft to the lateral urethral margins. Further anastomotic stitches are used to approximate the graft to the urethrotomy. A Foley catheter is then placed, and the ventral aspect of the urethral meatus is recreated by sewing the graft to the previously created periurethral flap with 5–0 Vicryl. The suction may be unclamped and hemostasis is assessed using a bulb syringe.
- Step 10: quilting and anterior vaginal wall reconstruction. The periurethral flap is then quilted to the graft in a tension-free fashion to improve graft take. Finally, the anterior vaginal wall is reapproximated to its margins in a tension-free fashion with an 0-Vicryl suture.

Follow-up testing with a VCUG 4 weeks post-surgery to assess for urethral stricture, leakage, obstruction, or graft failure is recommended. The suprapubic tube is removed if the VCUG demonstrates appropriate healing.

Conclusion

Ventral-onlay urethral reconstruction with a buccal mucosal graft is an effective and well-tolerated surgical procedure for women with FUS refractory to conservative treatment. This video may be used to facilitate the reproducibility and comprehension of this procedure for surgeons taking care of patients desiring definitive treatment for FUS.

Compliance with ethical standards

Conflicts of interest AP, HS, JK, KS, GC have no conflicts of interest to disclose.

CG has affiliations with Coloplast and AMS, and is the American Urologic Association Public Policy Chair.

AH is part of the speaker bureau for Astellas.

Consent Written informed consent was obtained from the patient for publication of this video article and any accompanying images.

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