Posterior Urethral Reconstruction

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1. Introduction

Posterior urethral stenoses are rare and extremely challenging to manage due to the complex anatomy in the area. Stenosis of the posterior urethra (PUS) typically result from pelvic trauma or treatment fo benign or oncologic prostate conditions. **PUS include bulbomembranous strictures (BMS), prostatic strictures, and bladder neck stenosis which can be either bladder neck contractures (BNC) o vesicourethral anastomotic contractures (VAUS). BNC are stenoses resulting from BPH outlet procedures or radiation therapy while vesicourethral anastomotic contractures (VUAS) are stenoses occurring after open or robotic radical prostatectomy.** Typically, initial management is endoscopic, however, failures require open or robotic reconstructive management. End-stage managem often involves indwelling catheters or urinary diversion.

2. Anatomy

The male urethra measures 18-20cm from the bladder neck to the urethral meatus. The anterior and posterior segments are delineated by the perineal membrane. **The posterior urethra, approximately 4cm in length, includes the bladder neck (pre-prostatic urethra) proximally, the prostatic urethra, and the membranous urethra distally.**[1] The 1.5cm membranous urethra begins 2.5 cm posteroinferior to the symphysis pubis and traverses the perineal membrane where it becomes the bulbar urethra. The membranous urethra is at high risk for injury due to its lack of distensibility and absen of protective surrounding spongy tissue or prostatic parenchyma[2].

The posterior urethra includes several important structures (**Table 1**).[3]

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Table 1

Posterior urethral segment	Structures and Landmarks	Histologic Features
Bladder neck (pre-prostatic urethra)	• Internal sphincter mechanism • Periurethral glands	• Epithelium contiguous with the epithelium of the trigone and bladder
Prostatic urethra	• Ejaculatory ducts • Verumontanum • Prostate smooth muscle continues into membranous urethra as the external smooth muscle sphincter	• Surrounded by prostatic stromal and glandular tissue • Epithelium is continuous with epithelium of the trigone and bladder
Membranous Urethra	• External (rhabodo)sphincter - omega shaped loop • Bulbourethral glands	• Lined with a delicate transitional epithelium • Surrounded by an outer layer of circularly-orientated striated muscle (external urethral sphincter) • 1.5cm long

3. Risk Factors and Pathophysiology

In general, urethral strictures occur from damage to the urothelium or underlying corpus spongiosum of the urethra. This abnormal narrowing of the anterior urethra is typically associated with some degree spongiofibrosis, but the posterior urethra has no surrounding corpora spongiosum.[4] Thus, narrowing of the anterior urethra is referred to as urethral “stricture” whereas narrowing of the posterior urethra is referred to as “posterior urethral injuries" or “posterior urethral stenosis”. Posterior urethral stenosis can further be defined as (1) (bulbo)membranous urethral stenosis (BMS), (2) prostatic urethral stenosis bladder neck contractures (BNC)/vesicourethral anastomosis stenosis (VUAS).[5]

Posterior urethral stenoses are usually an obliterative or near-obliterative process resulting in fibrosis and usually result from external trauma or prostate treatments. Straddle injuries and severe pelvic fractures may lead to the avulsion of the fixed bulbomembranous urethra from the urogenital diaphragm or directly lacerate the tissue from bony fragments of the fractured pelvis leading to obliterative or near-obliterative defects which are associated with extensive fibrosis between two distracted ends of the urethra (**Figure 1**).[6,7,8] Prostatic urethral strictures, VUAS, and BNC are typically the result of prostat cancer management (radiation, open and robotic-assisted radical prostatectomy) or treatment for bladder outlet procedures with endoscopic techniques leading to tissue ischemia and scar formation, howe the true etiology of post-TUR strictures remains controversial.[4,9]

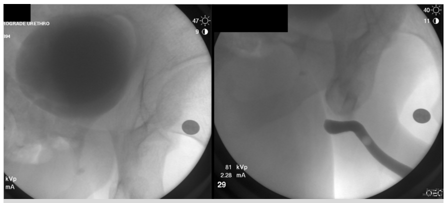

Figure 1: VCUG and RUG showing a pelvic fracture urethral injury resulting in 4-cm distraction defect.

4. Epidemiology

The incidence of urethral stricture disease may be as high as 0.6% of the male US population. A majority of these are **anterior bulbar strictures**.[4,10] Posterior urethral stenosis is much less common; in western countries, membranous urethral stenosis make up approximately 6-8% of all strictures.[11]

Non-traumatic causes include prostate cancer and bladder outlet interventions. Transurethral prostate surgery may cause tissue ischemia from prolonged radial pressure leading to fibrosis of the urotheliur and surrounding tissue.[12] It is not surprising then that endoscopic prostate outlet procedures are associated with nearly 40% of iatrogenic urethral stricture disease.[13] Endoscopic prostate outlet procedures lead to BNCs in 0.3-9.7% of cases, with no significant difference by energy modality.[14,15]

Prostate cancer therapy is associated with elevated risks of urethral stenosis. Radiation to the pelvis can cause cycles of healing and scarring that attenuates tissue vascularity leading to fibrosis and highe doses of radiation leads to increased risk of stenosis.[12] Rates of stenosis after prostate cancer radiotherapy may present in a delayed fashion and range from 2% for those with external beam radiotherapy t 4% for brachytherapy and 11% in those that undergo both (**Figure 2** and **Figure 3**).[16,17] Radical prostatectomy is associated with a 1-3% rate of VUAS.[18] VUAS occurs more often after open radical retropub prostatectomy compared to the robotic-assisted laparoscopic technique (7.5% vs 2.1%) and may be related to technical factors such as salvage treatments, anastomotic tension, or post-operative urine lea hematoma. VUAS are typically detected in the first year following surgery while adjuvant or salvage radiation increases the risk and complexity of VUAS.[19,20,21]

Pelvic trauma may cause isolated or concomitant urethral injury though the incidence is decreasing over time.[22] The bulbar urethra is the most commonly injured, but 3-6% of male and female patients with pelvic fractures have associated posterior urethral injuries.[8]

5. Diagnosis and Preoperative Evaluation

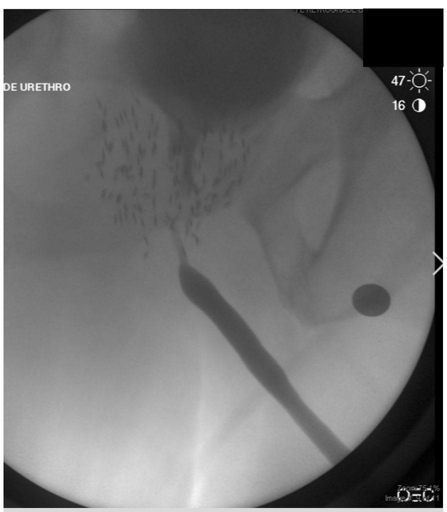

Figure 2: RUG of a bulbomembranous stricture following brachytherapy for prostate cancer.

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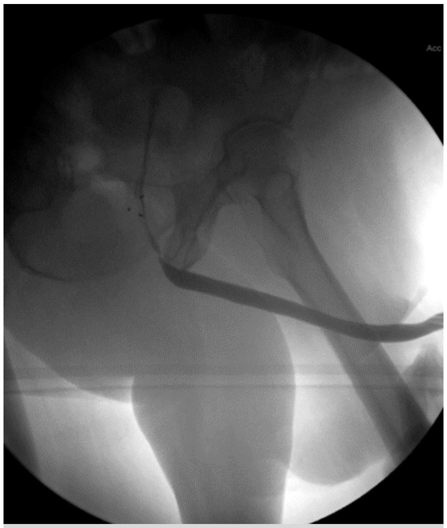

Figure 3: RUG showing a long posterior urethral stricture following external beam radiation therapy for prostate cancer.

5.1 Surgical timeline

The timing of surgical intervention is typically determined by the mechanism. Prior to any reconstructive surgery, urethral rest with avoidance of urethral manipulation should be considered for at least 6 we and up to 3 months to allow the stricture to mature and “declare” it's true extent.[5] Suprapubic tube diversion should be considered for individuals with voiding difficulty or urinary retention to avoid urethral catheterization. Urethrography should be performed prior to any reconstruction after an appropriate period of urethral rest. Posterior urethral stenosis and bladder neck contractures not secondary to extern trauma may be treated as soon as possible.

A majority of individuals with urethral injuries secondary to pelvic fractures or perineal trauma will have concomitant injuries and soft tissue trauma associated with the injury. **Acute management is determined by the patient presentation and type of urethral injury**.[8] Timing of surgery after isolated pelvic fracture urethral injuries (without concomitant bladder or rectal injuries) has been historically controversial. Urethral surgery should be delayed until more pressing medical and surgical issues are resolved. In the immediate setting of traumatic urethral injury, primary early anastomotic repair has hig complication rates including recurrent stricture (mean 54%), erectile dysfunction (ED) (23%), and urinary incontinence (UI) (14%).[23] Primary endoscopic alignment to establish continuity of the urethra is als controversial. It can be considered in partial straddle injuries or PFUI but is not possible with complete injuries.[24] In isolated urethral injuries, most reconstructive urologists advocate for minimal primary realignment efforts, early placement of suprapubic tube (SPT), and repeating urethrography in several weeks to define the resultant stricture/stenosis.[8] Furthermore, waiting at least 3 months after the index incident prior to reconstruction allows the stricture to mature, reduces tissue inflammation, and allows for easy antegrade access to the urethra via SPT during reconstruction.[4,23]

5.2 Pre-op Evaluation

Diagnosis of posterior urethral stenosis is similar to that of anterior urethral strictures.[10] The characteristics and etiology of the stenosis are the most important factors in determining the most successful management option. A complete history and examination are the first steps in determining the best approach for a posterior urethroplasty. Specifically of interest are oncologic history and treatment, past perineal or pelvic trauma, and previous surgical interventions. Patient-reported outcome measures (PROMs) can be used to identify obstructive symptoms. Helpful PROMs may include: International Prost Symptom Score (IPSS), Sexual Health Inventory for Men (SHIM), Male Sexual Health Questionnaire (MSHQ), and the **Urethral Stricture Symptoms and Impact Measure, (USSIM), the only validated stricture-specific PROM**.[25,26]

The history of present illness should include detailed symptoms, including infections and preoperative urinary and erectile function. Urge, stress, and mixed UI should be documented. If unc etiology of incontinence, urodynamic studies can be considered. Pre-operative erectile function is important to note. **ED may be associated with traumatic nerve or vascular injury particularly after a pelvic fracture**.[23] If pre-trauma erectile function was normal, penile doppler studies may be performed to assess for penile insufficiency. If detected, penile microvascular revascularization surgery may be considered prior to urethroplasty to potentially minimize ischemia to the urethral reconstruction site and penis.

A thorough genital exam is recommended prior to any urethral reconstruction, especially if the patient has a history of external trauma. The exam should take careful notice of penile skin integrity, scar tissu hematoma, fistula, or abscesses in the perineum. Additionally, **assessing the patient’s ability to be placed safely in dorsal lithotomy position is critical prior to consideration of reconstruction.**

Imaging studies including voiding cystourethrogram (VCUG) and a retrograde urethrogram (RUG) are often used in conjunction with cystoscopy to evaluate urethral patency and quality.[27] Fluoroscopic imaging can be helpful in determining the length of the urethral defect or stenosis which will guide treatment options. Retrograde urethrography may not be able to visualize the proximal exten a stricture, particularly if obliterative. Antegrade studies can help provide a more accurate picture of the stenosis. Cystoscopy can be performed both retrograde or antegrade (via suprapubic tube tract) for obliterative pelvic fracture urethral injury (PFUI) or straddle injury lesions.[28] Ureteroscopes (4.5 - 6.4 Fr) may be used to pass narrow strictures.[29] Direct visualization of the lower urinary tract helps visualize bladder pathology, urethral tissue quality, and other intraluminal lesions such as false passes or foreign bodies, like surgical clips. Cystoscopy is particularly important in posterior stenosis as a bulbomembranous urethral stenosis may not be apparent on RUG due to its proximity to the external urethral sphincter.

Bladder neck competency and patency can also be assessed on imaging studies. In patients with a history of prostate interventions or pelvic radiotherapy, narrowing at the bladder neck during voidir may be suggestive of a bladder neck contracture. Further workup with a cystoscopy is warranted in these situations to distinguish between a functional and anatomic bladder neck narrowing. A closed blad neck at rest suggests an intact internal sphincter mechanism which may confer postoperative continence. An open bladder neck may be indicative of bladder neck trauma or injury in the appropriate clinica scenario. If the patient has experienced no trauma, an open bladder neck may suggest bladder neck dysfunction and potential postoperative incontinence. This may especially be the case in individuals tha have had a previous prostate outlet procedure, bladder neck dilation, or prostatectomy where the bladder neck and internal sphincter mechanism may have been compromised. While the predictive value c fluoroscopic findings are not definitively associated with postoperative urinary incontinence, it is a helpful discussion point during preoperative counseling. [30]

Magnetic resonance imaging (MRI) has been previously used to evaluate the length of the urethral defect and adjacent anatomy including post-trauma changes in patients with PFUI**, and may be helpful i predicting which maneuvers may be required during posterior urethroplasty.**[31,32] Ultrasound urethrography, which may be used to characterize anterior strictures do not have a role in posterior urethr stricture diagnosis secondary to obvious anatomical limitations.

6. Treatment and Surgical Techniques

Urethroplasty is the definitive management for treating most anterior urethral strictures. However, d**ue to the location of repair deep in the perineum and surrounding anatomy, reconstruction in posterior urethral stenosis can be technically challenging and may disrupt the continence mechanisms.** Conservative measures include clean intermittent catheterization and chronic indwelling catheters, including suprapubic tubes for individuals that are poor surgical candidates. Endoscopic management is often initially utilized for non-obliterative stenosis to avoid devastating complications like U and ED which are more often associated with surgical reconstruction. **Endoscopic approaches should be avoided in those with complete obliteration of the lumen.** Reconstructive options such as urethroplasty and bladder neck reconstructive surgery are recommended in those that fail endoscopic management or have obliterative defects. Current commonly used reconstructive techniques have sim patency and UI rates. Ultimately 6-10% of patients with posterior urethral stenosis will require urinary diversion or chronic catheter due to treatment failure or subsequent sequalae like urethral fistula formation.[5,33]

6.1 Endoscopic Management Options

6.1.1 Bulbomembranous stenosis

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Bulbomembranous stenosis (BMS) are typically the result of radiation or prostate outlet therapy. Treatment of non-obliterative membranous urethral stenosis is mainly directed towards maintaining the integ of the external sphincter and patients should be warned about the risk of de novo incontinence and recurrence, particularly in patients with a history of radiation.

Dilation or direct visual internal urethrotomy (DVIU) can be performed as a first-line option for radiation-induced or non-traumatic BMS. When performing DVIU in the posterior urethra, the 6 and 12 o'clock positions should be avoided to prevent rectal injury and symphyseal fistulas, particularly in those that have a history of radiation. Success/patency rates vary from 51-69%; the risk of de novo UI may be up 11%. [5]

Balloon dilation may be preferred to DVIU to decrease the risk of de novo incontinence.[34] For short post-traumatic non-obstructive stenosis (<1.5cm), patency rates after one dilation are low (20%) with risk de novo UI (4.1%).[5,23] Repeat endoscopic approaches can be considered to stabilize the stricture in poor operative candidates but may need to be done at unpredictable intervals. Recurrent endoscopic treatments may lead to increased risk of fibrosis and delay definitive treatment.[35] Alternative reconstructive techniques should be considered early after endoscopic failure.

6.1.2 BNC and VUAS

Endoscopic treatment can be performed as a first-line treatment option for non-obliterative BNC or VUAS.[5,27] Treatment can be performed with dilation, DVIU, or transurethral resection (TUR), with compara outcomes. Patients should be counseled about the risk of urinary incontinence after any endoscopic procedure.

The success/patency rates of a bladder neck incision or bladder neck resection are comparable, thus approach is dependent on surgeon preference.[27] In individuals undergoing TUR of the bladder neck stenosis, recurrence rates between VUAS and BNC were comparable (60.3 vs 44.2, p=0.091); de novo UI rates varied significantly with a rate of 13.8% in those with VUAS and 0% in those with BNC. A his of radiotherapy appears to increase the risk of failure.[21]

Treatment of first time VUAS is 50-80%, and thus repeat treatments may be required for successful patency.[27] A number of studies are underway to improve the outcomes of endoscopic treatment, particularly after recurrence. Mitomycin –C is an anti-neoplastic agent which may prevent recurrent scar formation by stimulating endogenous collagenase and improve patency rates. However, there is conflicting data about the utility of Mitomycin-C for the treatment of recurrent VUAS, and further study is necessary to validate its use.

Additionally, a novel endoscopic technique for BNC and VUAS treatment was recently published showing promising outcomes. In this technique, the bladder neck was incised followed by transurethral mucosal realignment using a laparoscopic suture device.[36] Patency was 98% after one procedure and 100% after 2 procedures at a median follow up of 6 months. No patients had de novo UI. Further stud needed to validate this technique.

Patency rates may decrease with more endoscopic interventions for BMS, but this does not appear to be the case with VUAS and BNC, unlike urethral strictures in the anterior urethra. The cumulative suc in those undergoing multiple treatments appears to be higher 75-100%. [18] CIC and alternative options for open and minimally invasive reconstructive surgery can be considered for recalcitrant stenosis.

6.2 Reconstructive Management of Posterior Urethral Stenosis

6.2.1 Anastomotic Urethroplasty

Short obliterative BMS often associated with PFUI or radiation-induced are most often managed through a perineal approach with an anastomotic urethroplasty, or excision and primary anastomosis (EPA) PFUI, ED is often pre-existing and related to the injury and UI is rare as the bladder neck is typically intact. Optimizing outcomes after this surgery requires a tension free-anastomosis.

The standard approach uses a perineal incision which is taken down to the perineal body. The bulbomembranous urethra is exposed and mobilized circumferentially down to the perineal membrane where circular muscle fibers of the external urethral sphincter is lateralized off the membranous urethra so it can be spared. The bulbar arteries may be ligated during the mobilization, though bulbar artery sparing techniques have been described. [37] An antegrade sound or cystoscope may then be required to identify the distraction defect. The urethra is divided and the scar is then excised sharply in its entirety. Whe healthy urethra is encountered, the ends are spatulated and should accommodate a 28Fr bougie. A circumferential repair is then performed with absorbable sutures placed circumferentially and parachuted complete the anastomosis. The anastomosis must be tension-free and adequate distal mobilization should be performed. Several maneuvers may be required to access the urethra proximally and decreas the travel distance to the proximal urethral end including: (1) bulbar urethral mobilization from the perineal membrane to the suspensory ligament (2) crural separation, (3) inferior pubectomy, and (4) supracrural rerouting.[2] It has been suggested that gaps of up to 2.5-2.0 cm will likely require bulbar mobilization +/- crural separation and longer defects may require other techniques including abdominoperineal approaches. Preoperative investigations may provide insight on what elaborated measures may be required at the time of repair.

The EPA urethroplasty offers good long-term success rates and offers overall patency rates of 85.7% - 89%, ED rates of 12.7% and UI rates of 6.8% from analysis from a recent review of 3520 patients tha underwent delayed urethroplasty for PFUI.[8,23] Anastomotic repair for radiation-induced BMS has similar outcomes with an 85% patency rate at 2 years, UI in 7-19% of patients and rare incidence of late recurrence (2.7%).[35] Patient age and stenosis length are associated with post-EPA recurrence in radiation-induced BMS.[38] More nuanced data shows that patency outcomes may be dependent on maneuve performed during the procedure. For example, supracrural routing may lead to high failure rates, between 64-75%.[2]

Non-transecting anastomotic posterior urethroplasty which excises or incises the scar without full-thickness urethral transection can be used in short BMS strictures with satisfactory patency and post-opera continence and ED outcomes compared to the transecting anastomotic EPA. Ideal patients have mild fibrosis, a strictures or stenosis <2.0 cm, and pre-op preserved sexual function.[39,40,41,42]

6.2.2 Substitution Urethroplasty

Substitution, or tissue transfer, urethroplasty is an alternative approach for non-obliterative posterior urethral stenosis (specifically BMS) of non-traumatic etiology using buccal mucosal graft (BMG) placed ventrally or dorsally to augment the urethra. This approach may avoid the need for elaborate measure required for the EPA and may theoretically decrease the rate of ED and recurrence as it avoids transaction of the urethra preserving urethral vascularity.[43] This is particularly useful when considering the need for post-reconstruction artificial urinary sphincter (AUS) for UI.

Similar to anterior urethroplasty, ventral and dorsal buccal augmentation approach can be used in reconstructing non-obliterative defects, example in **Figure 4**. A midline incision or perineal flap made by creating an inverted U incision may be helpful in accessing the deep perineum and dissecting the anal sphincter inferiorly. The bulbospongiosus muscle and perineal body is dissected off the urethra to allo access to the posterior urethra if a ventral approach is used. If a dorsal buccal approach is considered, the circular fibers of the external sphincter and cavernous nerves must be lateralized from the urethra urethrotomy can be performed after the urethra is isolated and this is carried down to the proximal extent of the scar. This may be performed over bougies-a-boules, a urethral catheter, or a wire. The BMG approximated to the defect per standard technique. A gorget or narrow speculum may assist with placement of the sutures at the proximal apex.[43] In high risk stenosis, particularly those spanning the bulbomembranous junction through the prostatic urethra or bladder neck using a ventral BMG with a gracilis interposition flap may help improve outcomes, particularly in those with poor vascular supply for graft take secondary to radiation or trauma (**Figures 5-7**).[44]

In a recent multi-institutional study of dorsal BMG in post-radiation stenosis, 82.3% patients remained patent and 8.1% of patients developed de-novo UI.[45] The ventral bulbomembranous urethra can be accessed with less urethral mobilization than the dorsal approach theoretically preserving the external urethral sphincter and making BMG grafting technically easier.[46] In a series of bulbar and bulbomembranous strictures repaired with ventral BMG augmented urethroplasty including radiated patients, patency at 26.5 months was 71.1%. The overall UI rate was 42% and de novo UI rate was 10% with 6.3% reporting ED worse than preoperatively.[47] A more recent series evaluating men with only bulbomembranous strictures after pelvic radiation showed a 33% recurrence rate of stricture at a median follow up of 45 months.[48] Interestingly, in this series focusing on patient reported outcomes, a majority of men reported engaging no sexual activity at all (pre- and postoperatively), leading the authors to conclude that high ED rates following surgery may not be de novo, rather related to previous therapy.[48]

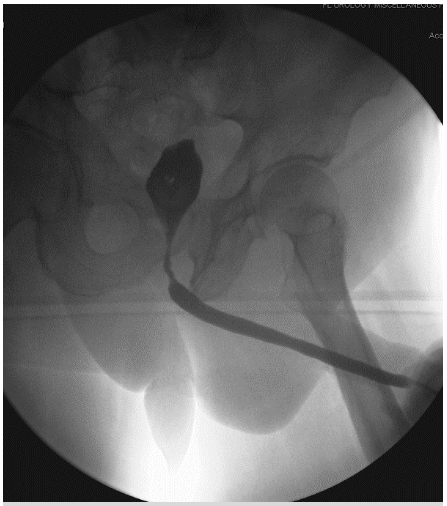

Figure 4: RUG showing a 2 cm stricture from the bulbomembranous junction to the bladder neck in patient who is status post prostatectomy and adjuvant radiation.

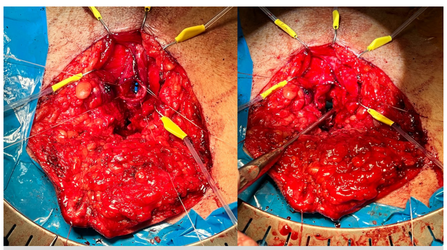

Figure 5: A ventral urethrotomy is made and carried down to the proximal extent of the scar. In this patient, the urethrotomy is carried down through the bladder neck and the foley balloon can be seen in the bladder.

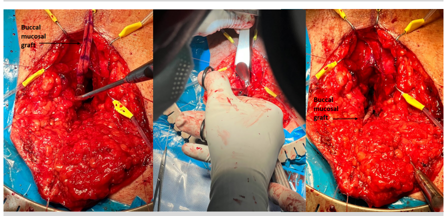

Figure 6: A buccal graft is placed on the ventral urethra. The proximal apical approximation of the graft often requires "parachuting" of the sutures using tools, like a gourget.

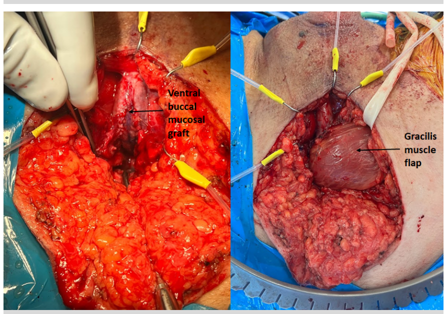

Figure 7

6.2.3 Recurrent Vesicourethral Anastomosis Stenosis and Bladder Neck Reconstruction

Revision of the anastomosis can be considered for individuals that are not candidates for (obliterative defects) or fail endoscopic management. Extensive reconstruction should only be considered in individuals that have adequate bladder function and capacity and no evidence of complicating urethral pathology such as calcifications or fistulas.[5] Both robot-assisted and open surgeries have been descri utilizing retropubic and/or perineal approaches. A clear takeaway from outcomes of both of these approaches is the high incidence of de novo UI which must be discussed with the patient preoperatively. Management of postoperative UI is often an artificial urinary sphincter (AUS) which can be placed after confirming patency at 3-6 months.[49]

One benefit of the transperineal approach in VUAS is dissection through virgin tissue planes. The technique is similar to that of a posterior urethroplasty and can be used for short VUAS. The perineal body taken down and the proximal membranous urethra is mobilized, divided, and spatulated after the external urethral sphincter is dissected off. Then a sound is placed through the suprapubic tract antegrade allowing for visualization of the anastomosis from the perineum. Inferior pubectomy and corporal splitting may be required. The scar at the anastomosis is then excised and a primary anastomosis is perfor using pre-placed absorbable sutures which are parachuted down.[18] Despite high patency rates (91.3-100%), the open transperineal approach has very high rates of ED and UI, approaching 100%, especia in those that have previous pelvic radiation.[18,50]

Use of the abdominal or retropubic approach may be more difficult as the surgical planes have previously been violated. Continence rates are improved however, and the perineal plane and urethral vascu supply is preserved improving AUS outcomes should the patient require it. The abdominal or retropubic approach appears to have similar patency rates (after secondary endoscopy) with lower incontinenc rates. [20,50] UI rates vary in the literature are between 0-58%, but closer to 30% in more recent studies.[5,20] Abdominoperineal approach is considered a hybrid option with patency rates of 70-83% and high incidence of de novo UI.[20]

The robotic approach is now increasingly used for VUAS repair.[20] The posterior urethra lies above the urogenital diaphragm allowing for the intra-abdominal approach offered by the robot. The major benef for the robotic-assisted approach include (1) reduced perineal mobilization leaving a virgin plane for later AUS placement, (2) ability to perform partial or salvage prostatectomy if prostate is necrotic, and (3 improved visualization, particularly for the anastomosis. Additionally bladder mobilization techniques can be used to improve reach, opposing tissue quality, and minimize tension[51] With the robot-assisted technique, the bladder neck is approached anterior to the bladder and the bladder neck is dissected caudally off the posterior pubis and circumferentially. Retrograde cystoscopy can help in localizing the s tissue. The bladder may be incised to excise the scar intravesically with either electrocautery or sharply and the bladder can then be anastomosed. A Y-V plasty may also be utilized to avoid dissection of t posterior plane. A Y-incision is made at the bladder neck though the anterior aspect of the scar and the apex of the V is advanced distally to augment the bladder neck lumen. [52] Partial prostatectomy may b needed for those that have a prostate in situ and are undergoing BNC release. A retrospective analysis of the TURNS database of 5 patients with VUAS and 7 with BNC showed a 75% success rate with a novo IU rate of 18%. [52] In those that required an open perineal mobilization to achieve a tension-free anastomosis, the de novo UI rate was 33% and de novo ED rate was 16.7%.[53]

7. Post-operative Care

Most urethroplasties can be discharged home the same day with a catheter in place. Individuals with more complex reconstructions involving the use of a gracilis muscle flap or pubectomy may be admitte Non-narcotic post-operative pain management is feasible and preferred by the authors. [54] Peri-procedural antibiotic prophylaxis for the duration of the catheter is controversial. Antibiotic prophylaxis at the of catheter removal is, however, recommended for most individuals, especially those with risk factors.[55]

A catheter should be left across the reconstruction for at least 2-3 weeks or longer depending on the characteristics of the reconstruction. Pericatheter urethrography or voiding cystourethrogram should be performed prior to catheter removal to avoid complications related to urinary extravasation. Imaging choice is dependent on complexity of the surgery and risk of leak. [5] If there is a high grade leak, the cath should be replaced or kept in place for repeat imaging 1-2 weeks later. [56]

Following a successful catheter removal, patients should get regular monitoring with PROMs, uroflowmetry, and cystoscopic assessment for at least 1 year.[25] Subsequent evaluations are recommended at months, 24 months and 5 years though evaluation may differ by surgeon.[57] Successful treatment is typically defined as no further need for surgical intervention. Additional measures of success include min obstructive voiding symptoms, including adequate peak flow and minimal post-void residual.

8. Section Summary/Take Home Message

Posterior urethral stenosis present after various etiologies including bladder outlet procedures, prostate and pelvic radiation, and pelvic fracture urethral injury and are often difficult to manage. Managemer options are chosen based primarily on tissue quality, etiology, and extent of the stenosis (obliterative and non-obliterative) and have varying success rates. Endoscopic options may be considered in individuals who are poor surgical candidates but reconstructive management often has improved patency outcomes. Given the proximity to the continence mechanisms and neurovascular structures, the possibility of urinary incontinence and erectile dysfunction should be discussed with the patient preoperatively.

9. Clinical Care Pathway (see PPT)

10. Abbreviations:

AUS - artificial urinary sphincter
BMS - bulbomembranous urethral stenosis
BMG - buccal mucosal graft
BNC - bladder neck contracture
DVIU - direct visual internal urethrotomy
ED - erectile dysfunction
EPA - excision and primary anastomosis
MMC - mitomycin C
MRI - magnetic resonance imaging
PFUI - pelvic fracture urethral injury
PROM - patient-reported outcome measures
PUS - posterior urethral stenosis
RUG - retrograde urethrogram
SPT - suprapubic tube
UI - urinary incontinence
VCUG - voiding cystourethrogram
VUAS - vesicourethral anastomosis stenosis

Presentations

Posterior Urethral Reconstruction Presentation

Posterior Urethral Reconstruction Pathways

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