Perineal Urethrostomy: A Pearl in Failed Urethral Reconstruction

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31.1 Introduction

Urethroplasty surgery for urethral strictures is the preferred option to restore durable urethral patency offering excellent success rates. However, failure rates can be as high as 50% [1] for the most challenging patient presentations. In particular, patients with panurethral strictures (most commonly related to lichen sclerosus) and patients with multiple previous failed urethroplasties, such as hypospadias cripples, are considerably difficult to manage. Tissue scarring and a decrease in vascularity -be it due to the sclerosing disease process or secondary to recurrent instrumentation- impede wound healing and reepithelialization making stricture recurrences and in case of hypospadias cripples also fistula formation common. In addition to urethral complications, these patients are found to experience a diminished quality of life related to voiding and sexual dysfunction as well as depression [2, 3].

Often viewed as a last resort prior to abandoning the urethral outlet, creation of a perineal urethrostomy (PU) is a highly successful option for men with complex urethral stricture disease, and in some conditions may even halt the progression of disease [4]. However, amongst urologists, there appears hesitation to perform this procedure. In surveys of practicing members of the American and Dutch Urological Associations completed in 2002 and 2008, respectively, less than 10% of urologists had performed a PU in the previous year [5, 6]. Yet in recent years as the field of reconstructive urology continues to advance it appears that perineal urethrostomies are increasingly considered. Fuchs et al. noted a nearly ten-fold increase in PU procedures from 2008 to 2017, with also a trend towards performing the procedure in younger patients likely reflecting improved awareness of the limitations of tissue transfer [7].

31.2 General Indications

In general, PU is a reversible procedure, and this is utilized during staged urethroplasty. A generation of a neomeatus in the perineum is

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essential during the first-stage. In this setting, despite the intention for a complete reconstruction six or more months later, many patients may ultimately find PU as an acceptable diversion and elect to forgo the second stage. In fact, in those undergoing staged urethroplasty, only 24–58% of men pursued second stage, leaving 42–76% with a functional perineal urethrostomy [4, 8, 9].

More commonly, however, definitive PU is performed and the general indication is in individuals with complex anterior urethral strictures. Compared to extensive urethral reconstruction, PU is a relatively minor surgical procedure associated with earlier return to normal activity and catheter removal, while avoiding the morbidity of graft harvest site morbidity and maintaining more typical anatomy for aesthetic reasons. As such, PU may be a more sensible procedure in the elderly or in those with severe medical comorbidities for whom a prolonged surgery may be associated with higher perioperative morbidity and mortality [4]. Other times, the surgeon may recommend a PU due to poor quality of urethral and penile tissue, exhaustion of graft materials, and understanding of the disease process, which can contribute to inadequate reconstruction [4, 9]. Aptly put by Peterson et al., "heroic measures may not be justified" [4]. Finally, patients who would otherwise be candidates for a single-stage repair may elect to undergo PU instead of complex urethroplasty due to a history of multiple prior failed procedures and treatment fatigue. Barbagli et al. reported that patients electing PU instead of a complex urethroplasty were a mean age of 53 years, had undergone on average 4.5 procedures for hypospadias repair or 4.1 failed urethroplasty for other urethral conditions, and were unwilling to accept the possibility of another failed urethroplasty [9].

Outside of urethral stricture disease, a PU may be indicated in patients with traumatic or penile amputation. Following penile trauma or in the setting of penile or urethral malignancy, PU may be utilized as an alternative to placement of a suprapubic catheter or avoid more extensive surgery to create a urinary outlet such as appendicovesicostomy or even supravesical diversion such as an ileal conduit. The PU permits continent voiding and avoids complications associated with prolonged catheter use including urinary tract infection, bladder calculi, catheter blockage, and increased risk of squamous cell bladder carcinoma or risks of extensive surgery.

It should be noted that not all patients with urethral pathology should be considered for creation of PU. In patients with coexistent proximal urethral disease (posterior urethral stenosis or bladder neck contracture), a PU would obviously not relieve obstructive symptoms. In patients with urinary incontinence, creation of a PU could worsen urine leakage by bypassing the stricture, which in many cases comprises the patient's continence mechanism. In this setting, continuous leakage of urine through a PU is likely to cause wound complications. Additionally, the presence of a PU would make subsequent placement of an artificial urinary sphincter more challenging technically as well as likely increase the risk of complications [10].

31.3 Perineal Urethrostomy Techniques

There are several techniques described to generate a PU and approaches can broadly be divided into two categories: those associated with transection of the urethra and non-transecting techniques.

Non-transecting techniques such as the Johanson and Blandy techniques preserve the urethral plate, and thereby retrograde blood supply from the dorsal penile artery. This may decrease the rate of postoperative complications, specifically stenosis of the neomeatus [11]. Additionally, by maintaining the urethral plate, these techniques allow for the possibility for the urethra to be re-tubularized at a later date. In contrast, advantages of transecting techniques, such as the 7-flap, lotus petal flap, and also augmented PU techniques, are a more complete mobilization of the proximal urethral stump. This facilitates a tension-free anastomosis, especially in patients with increased

skin-to-urethra length (e.g., obese patients or patients with very proximal urethral strictures). However, while generally also reversible, the urethral transection and ligation of the distal urethra makes a subsequent reversal a more complex endeavor.

31.3.1 Non-transecting Techniques

31.3.1.1 Johanson Technique

Originally described in 1953 as the first-stage of a staged urethroplasty for pendulous urethral strictures, the Johanson technique has been adapted for use in the bulbar urethra for staged procedures as well as for permanent diversion in the form of PU [12]. In principle, the Johanson technique for PU creation involves marsupialization of the urethra to adjacent perineal skin and serves as blue-print of generating a PU as its evolution by the more elaborate techniques discussed below have some elements in common with the Johanson technique.

The patient is placed in a high lithotomy position. A vertical midline incision is made on the perineum extending from the posterior aspect of the scrotum to approximately 1–2 cm anterior to the anus (Fig. 31.1). After exposing the bulbar urethra, a ventral longitudinal urethrotomy is performed and extended proximally until healthy urethra is encountered. An incision of several centimeters is recommended to avoid stenosis of the neomeatus (Fig. 31.2). The presence of proximal urethral strictures, stenoses or bladder neck contractures should be excluded either with calibration to 24-28F or cystoscopically. As significant bleeding of the incised corpus spongiosum can be encountered, the cut edge of the corpus spongiosum can be oversewn with running locked absorbable sutures. The edges of the urethrotomy are then matured to the perineal incision skin edges with interrupted absorbable sutures [1, 8, 13].

In the event that the urethrostomy cannot be matured to the perineal skin in a tension-free fashion, scrotal skin can be invaginated towards the urethrotomy, with a vertical incision made along the median raphe of the scrotum to be used for stoma maturation [1, 8]. A urethral catheter is placed through the neomeatus but can typically be removed within 1 week.

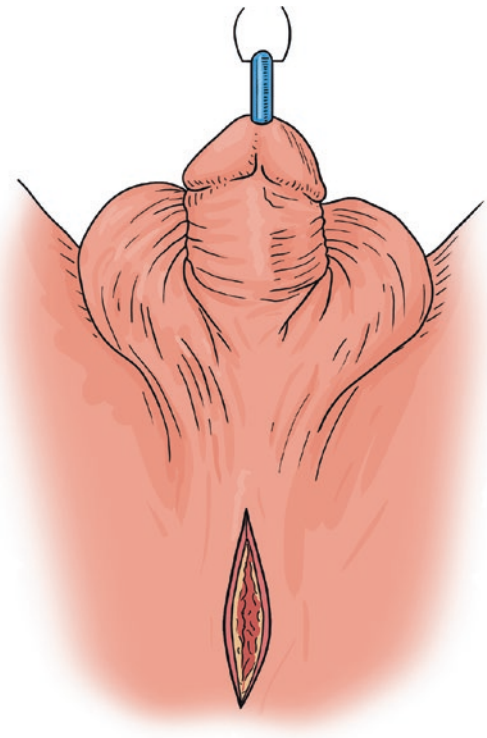

Fig. 31.1 Johansen PU: Midline incision over the urethra

The Johanson technique is a familiar concept to most reconstructive urologists due to its use as a first-stage approach for staged urethroplasty. However, due to the limited elasticity of the perineal skin, there may be significant tension when maturing the urethrostomy, particularly at the posterior-most aspect. This may predispose the incision to wound dehiscence and subsequent stenosis of the neomeatus. To address this concern, an invaginated scrotal flap as described above should be considered albeit this can be inconvenient for voiding. Alternatively, McKibben describe the utilization of a Z-plasty technique on the inferior aspect of the perineal incision to construct a tension-free urethrostomy with excellent success [14]. Regardless, use of this approach may be best reserved for thin individuals with pliant perineal skin in whom a tension-less anastomosis is more feasible.

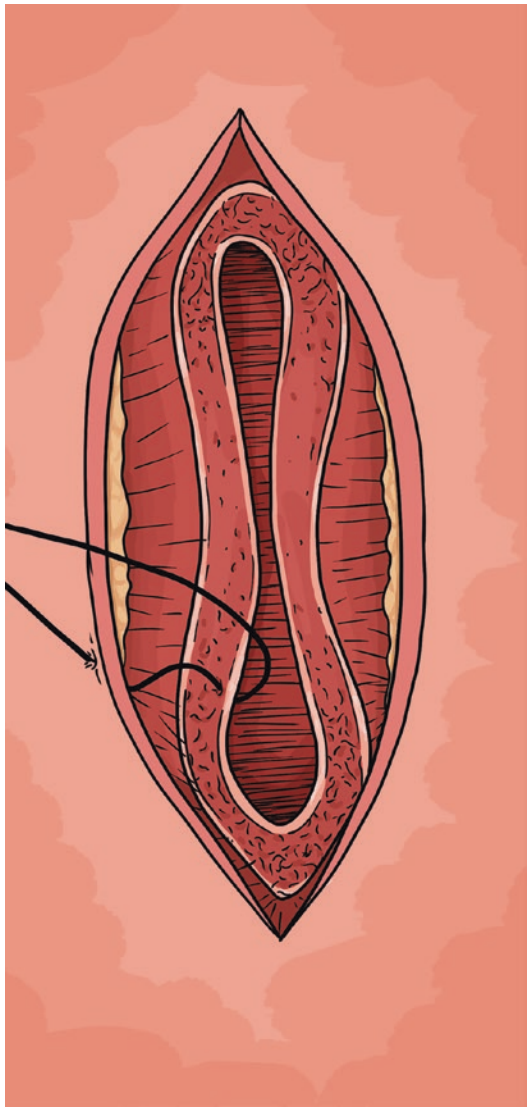

Fig. 31.2 Johansen PU: The urethra is opened longitudinally for several centimeters and the skin anastomosed to corpus spongiosum and mucosa

31.3.1.2 Blandy Technique [15, 16]

Developed as a modification of the Johanson technique due to high stenosis rate at the proximal apex of the PU, this technique was first described in 1968 [15]. By developing an inverted U-shaped scrotal flap, this approach can be used as a first-stage of a staged urethroplasty or for definitive PU.

The patient is placed in high lithotomy position and urethroscopy may be performed at the start to identify the proximal end of the stricture. This is marked on the skin and marks the point at which the flap would need to reach. The apex of the flap is marked out to be 3 cm anterior to this to allow the flap to drop into the urethra without tension (Fig. 31.3). The flap is marked out with the distal end of the flap being about 3 cm in width and a corresponding base created with an approximately 3:1 ratio. A 4 cm vertical midline incision is marked out anterior to the apex of the flap to form the edges of the dorsal urethral plate. Incision is made in the pre-marked lines and the flap is developed with a full thickness fat pad directly off of the underlying bulbocavernosus muscle in order to ensure good vascular supply to the apex of the flap. Next, the bulbar urethra is exposed, a ventral longitudinal urethrotomy is performed and extended proximally while placing stay sutures through mucosa and corpus spongiosum (Fig. 31.4) until healthy urethra is encountered and proximal urethral obstruction excluded. The urethrotomy should measure several centimeters (about 4–6 cm) to ensure durability of an adequately sized opening. The edge of the corpus spongiosum and the edge of the urethral mucosa are closed laterally with 4–0 absorbable sutures (Fig. 31.5). To mature the urethrostomy, three apical sutures are pre-placed in the proximal urethral opening and corresponding area on the flap (Fig. 31.6) allowing for optimal visual exposure, which is obscured once the inverted U-shaped flap is advanced into the defect. Next, the sutures are tied leading to a parachuting of the perineal skin flap to the proximal urethral stump (Fig. 31.7). The remaining skin incisions which were not utilized in maturing the PU are then reapproximated with absorbable suture (Fig. 31.8). A 20 Fr urethral catheter is placed and removed after 7–10 days.

The main drawback of the Blandy technique is that it relies on an accurate pre-incision assessment of the length of the flap needed to construct a tension-free anastomosis. Unfortunately, the preoperative assessment of urethral stricture disease

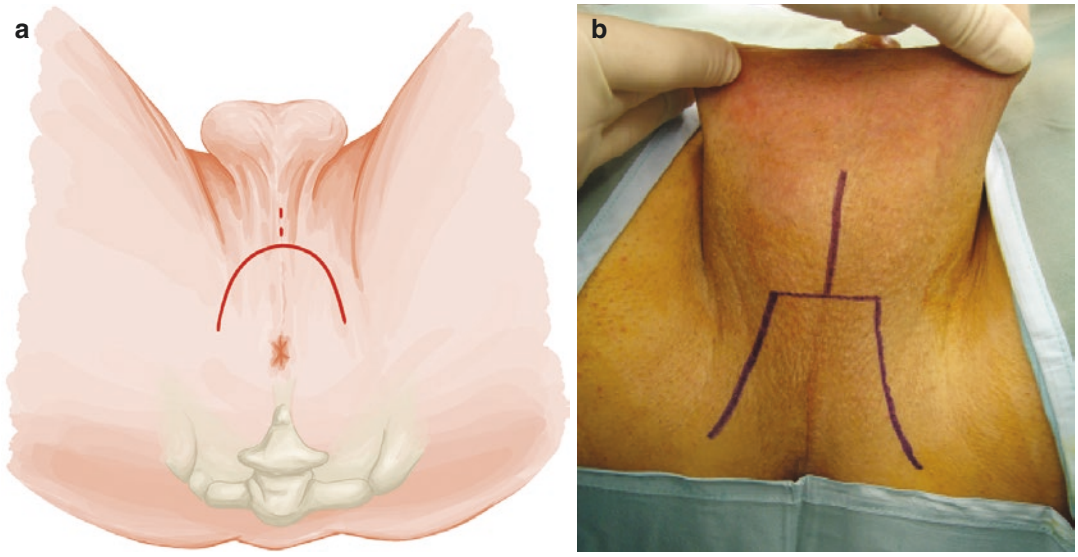

Fig. 31.3 Blandy PU: Outline of the skin incision either as inverted U (Panel **a**) or as trapezoid (Panel **b**). Note the perpendicular incision in the midline of the scrotum

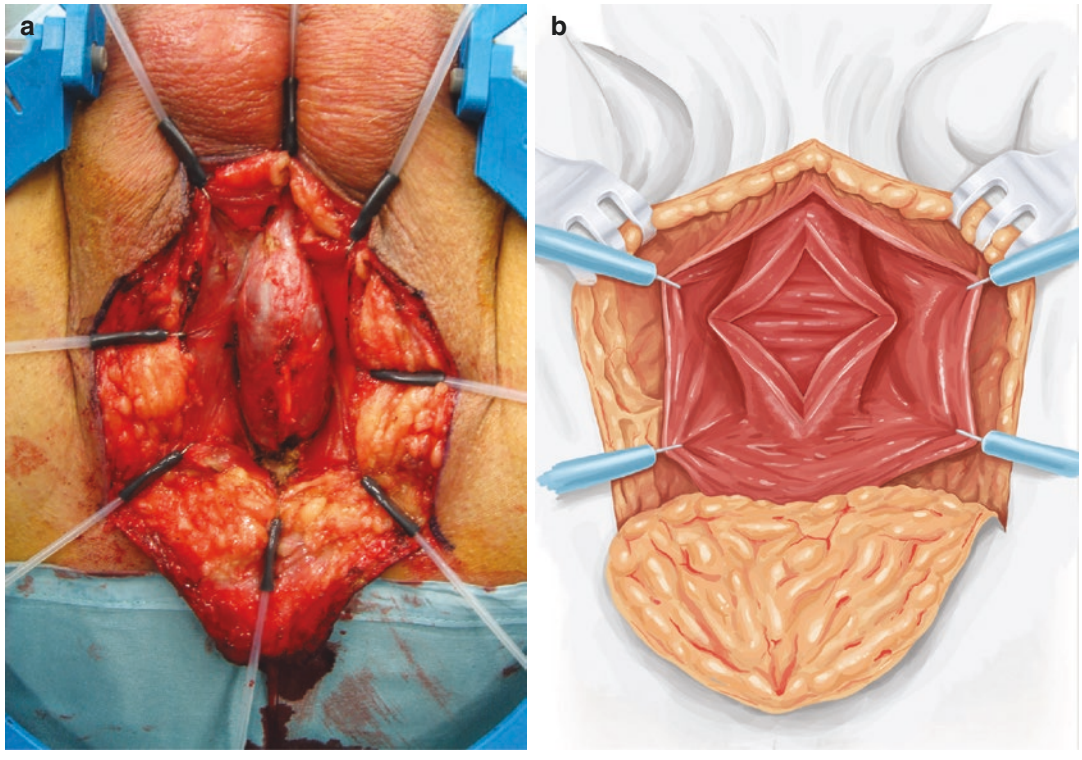

Fig. 31.4 Blandy PU: The urethra is exposed (Panel **a**) and then opened (Panel **b**). A ring retractor with hooks helps to expose the field

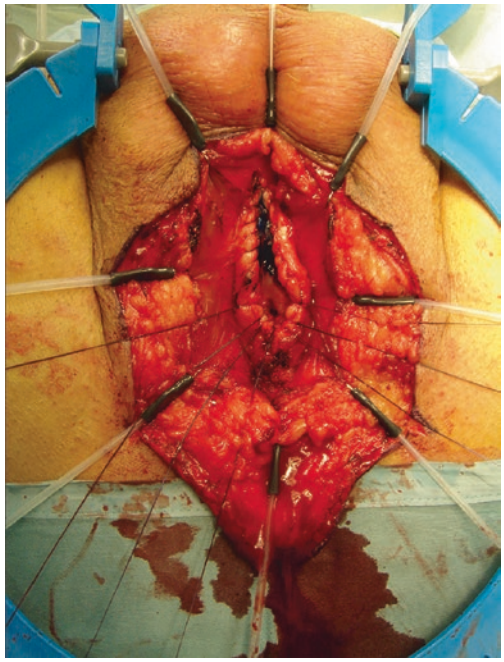

Fig. 31.5 Blandy PU: A running stitch through mucosa and corpus spongiosum closes the corpus and controls bleeding

is imperfect, with one study noting a correlation coefficient of only 0.69 between preoperative RUG and intraoperative stricture measurement [17]. It follows that if the stricture extends more proximally than expected before the initial incision, the flap may not be long enough to ensure a tension-free anastomosis and predispose to PU failure. Also, in its original report, about 10% of patients required a revision due to necrotic tip of the flap and some patients needed to self-dilate to break down skin bridges between suture lines. [16]

31.3.2 Transecting Techniques

31.3.2.1 7-Flap Technique

The 7-flap technique was first described in 2011 by French et al. [18] This approach utilizes a lateral-based perineal skin flap to create the urethrostomy. It also employs a vertical midline perineal incision, affording flexibility if a one-stage urethral reconstruction is intended but not possible and instead a PU is necessary. Conversely,

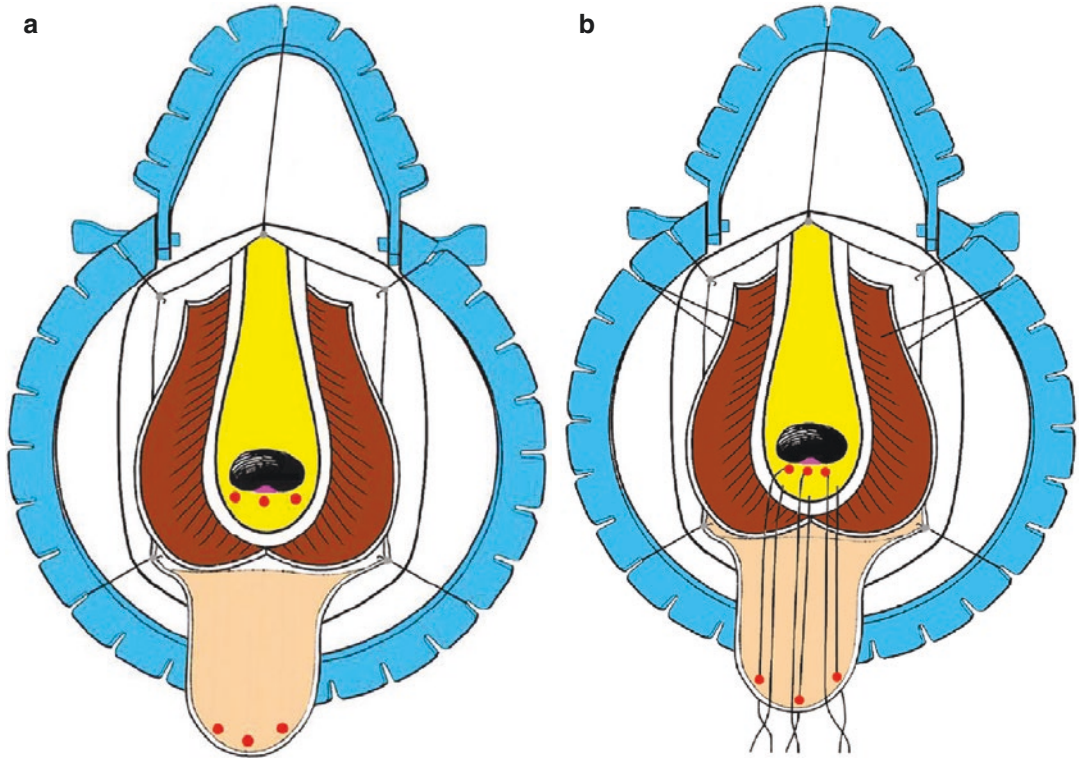

Fig. 31.6 Blandy PU: Three apical sutures are marked and passed in front of the verumontanum and placed in corresponding sites on the apex of the inverted U-shaped perineal skin flap (Panel **a** and **b**)

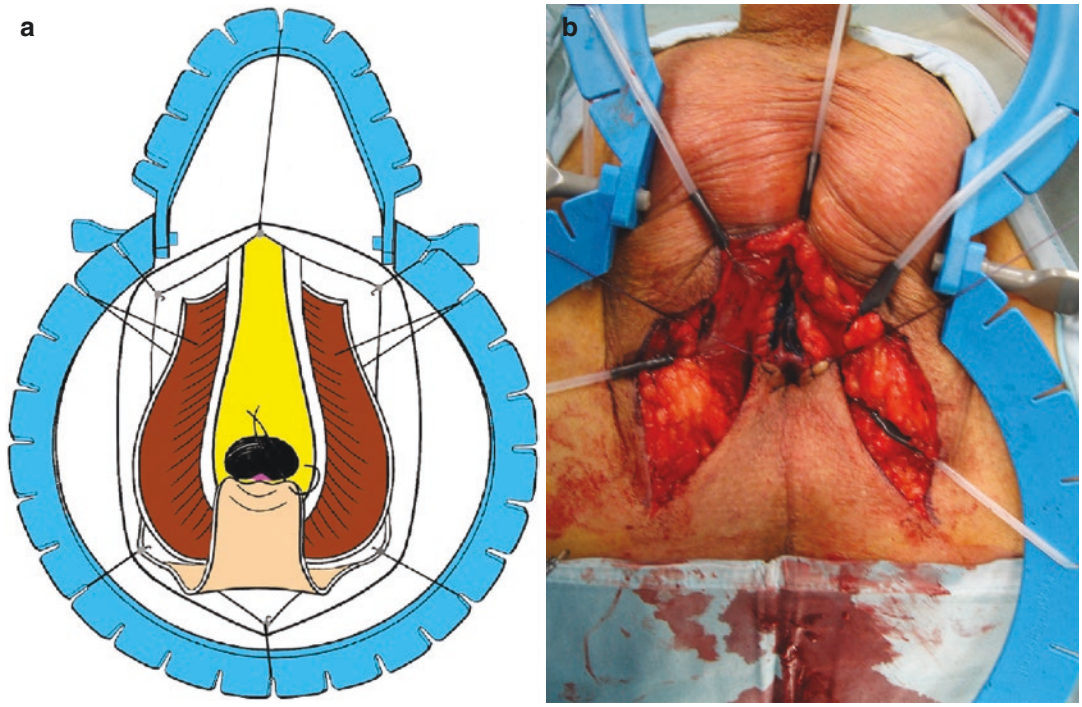

Fig. 31.7 Blandy PU: Upon tying the 3 sutures, the perineal skin flap is parachuted into the proximal urethral mucosa (Panel **a** and **b**)

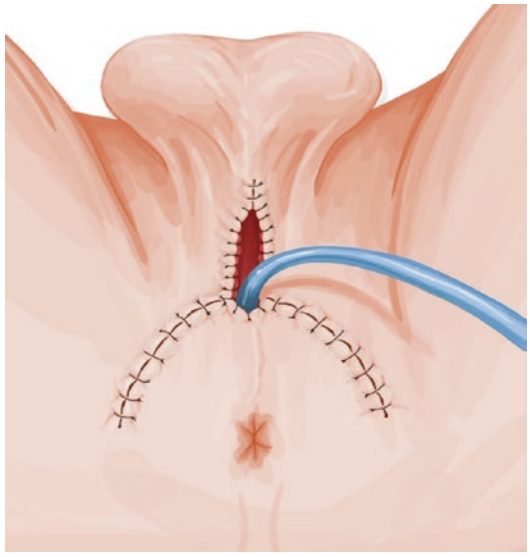

Fig. 31.8 Blandy PU: Remaining perineal skin is sutured to the urethral plate and remaining skin defect closed. A 20 Fr urethral catheter is placed and removed after 10 days

if a PU is being pursued but an orthotopic reconstruction is instead deemed possible this can be performed through this incision.

The patient is positioned in lithotomy position and the 7-flap delineated (Fig. 31.9) and the skin incised through a vertical midline perineal incision which is the stem of the "7". The bulbar urethra is exposed and transected at the distalmost possible level as determined by cystoscopy. The distal urethral stump is oversewn with running absorbable suture. The proximal urethral segment is spatulated at the at 9 o'clock aspect for about 1 cm and proximal urethral patency ensured by calibration or cystoscopically. On the same side as the urethral spatulation, the 7-shaped skin flap is created and tailored to fit the distance to the proximal apex of the spatulation (Fig. 31.10). The incision can be extended if a longer flap is needed to achieve a tension-free anastomosis. When developing the flap, it is necessary to ensure adequate thickness of the flap to prevent flap necrosis as well as an appropriate ratio of base to length of the flap (3:1 or more).

The apex of the 7-shaped flap is then matured to the apex of the spatulation in a "yin-yang" configuration using absorbable suture. The contralateral side of the proximal urethra is matured

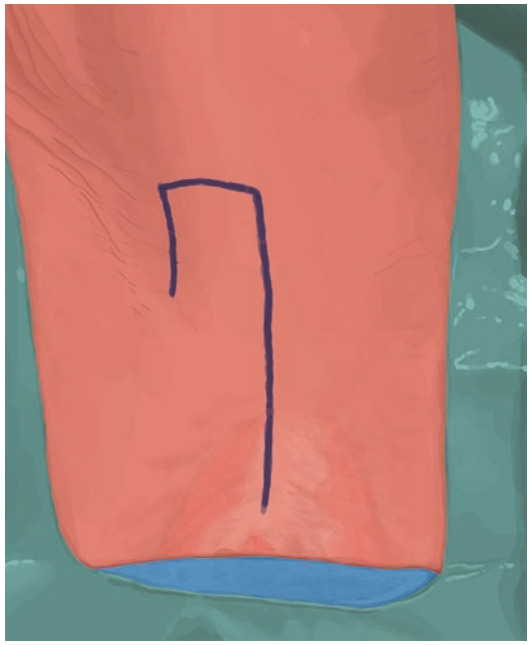

Fig. 31.9 7-Flap PU: Skin marking showing a squared 7-shape figure with the long vertical base placed in the midline

to adjacent perineal skin and the remaining incisions are re-approximated using absorbable suture. If the distance from the perineal skin to the proximal urethral stump remains too long, a second 7-flap can be fashioned on the contralateral aspect of the flap incision. The skin is closed to restore the perineum (Fig. 31.11). A catheter is placed through the neomeatus and maintained for several days [18–20].

The main advantage of the 7-flap technique is that the flap is fashioned *after* bulbar urethral dissection thus enabling an appropriately tailored skin flap to the patient's urethral stump in order to achieve a tension-free anastomosis. This allows for greater flexibility in those with proximal urethral stricture disease as well as in obese individuals, who have an increased skin-to-urethra distance. However, this flap is considered a random pattern flap and therefore the length should not extend beyond three times the width of the base in order to preserve vascularity to the flap. Notably, while the 7-flap technique

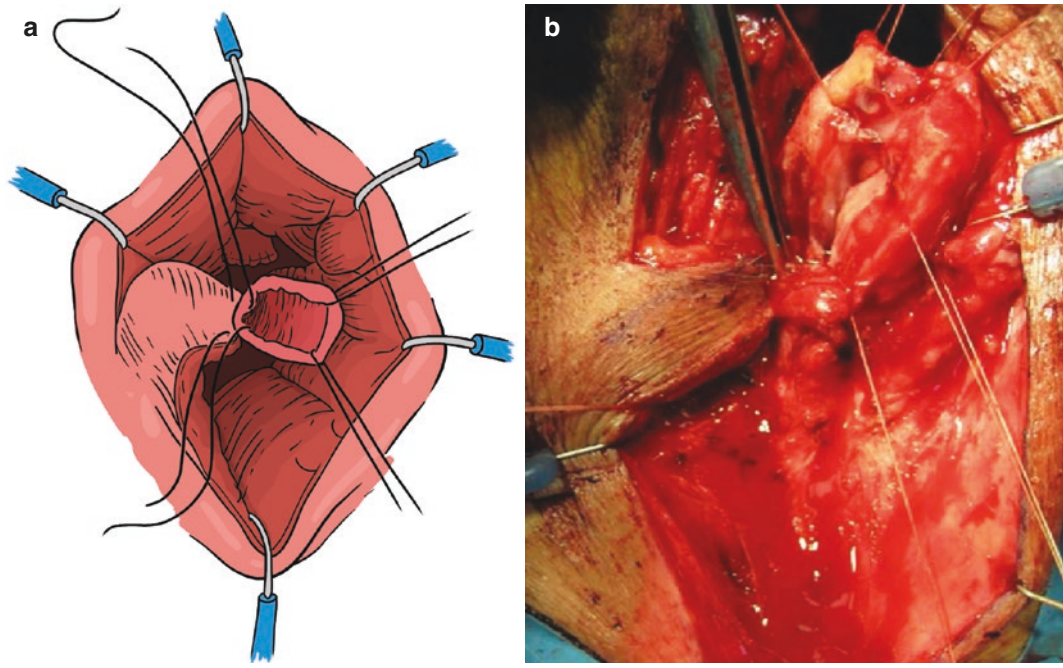

Fig. 31.10 7-Flap PU: Right lateral perineal skin flap is rotated medially, proximally and advanced down towards the proximal end of the urethrotomy (Panel **a** and **b**)

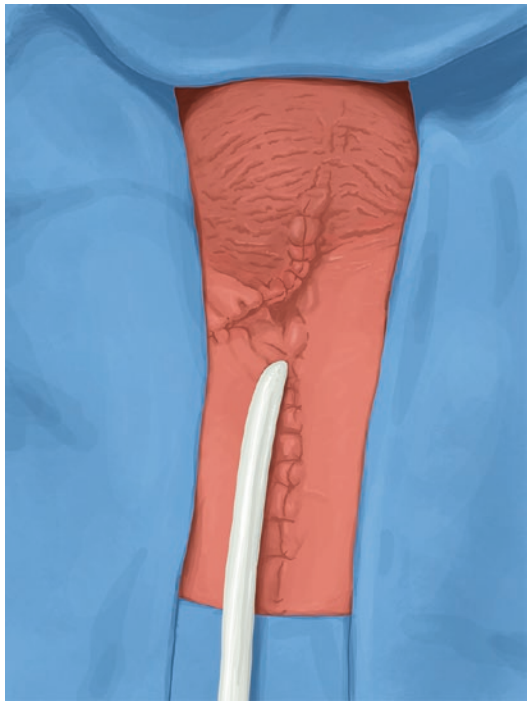

Fig. 31.11 7-Flap PU: Final result of the 7-flap perineal urethrostomy after skin closure and catheter placement

as originally described involves transection of the urethral plate, it has been adapted into to a non-transecting technique for patients with more distal strictures with good success rates [14].

31.3.2.2 Lotus Petal Flap

The lotus-petal flap was originally described in 1996 for use in the reconstruction females with perineal conditions by Yii et al. [21]. Its indications have since expanded to wounds of the male perineum and were described in 2018 for adaptation to PU bei Reilly et al. [22]. The strength of this technique is the use of a vascularized tissue based on regional perforator anatomy. This allows the skin to be mobilized deep into the perineum and shaped into a tubular structure whilst maintaining adequate blood facilitating a tension-free closure in high risk individuals.

The patient is placed in the lithotomy position. Using a Doppler ultrasound, perforators of the internal pudendal artery are identified and marked on perineal skin (Fig. 31.12). A midline vertical perineal incision is made and the bulbar urethra

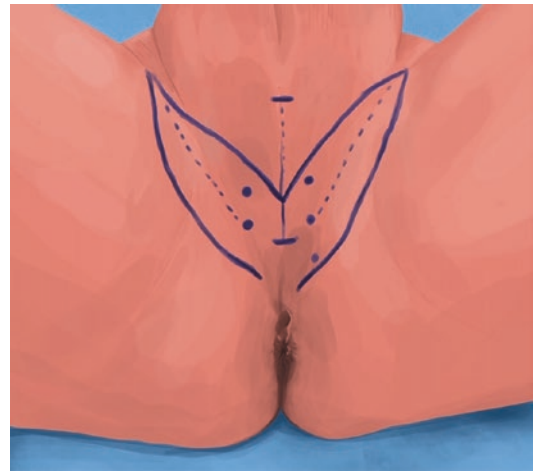

Fig. 31.12 Lotus Flap PU: Skin markings following perforator identification using hand-held Doppler ultrasound

is exposed. The urethra is transected as distally as possible (right at the point where healthy mucosa can be identified cystoscopically) The distal urethra is oversewn using absorbable suture and the proximal urethra spatulated and calibrated to ensure proximal urethral patency [22].

The distance from the proximal urethral stump to skin is measured and an appropriate length of lotus flap is marked out incorporating the previously identified perforating vessels. Incision is made along the marked flap and perforating vessels dissected out and preserved (Fig. 31.13). The flap is folded on itself to form a tube and secured with 4–0 monocryl. To achieve this, the skin flap can be completely islanded if desired (Fig. 31.14) or left with a posterior skin bridge intact. 4–0 monocryl absorbable sutures are then used to inset the skin flap to the urethral margin incorporating the spongiosum as well. The donor site is closed in layers over a suction drain, which is usually removed on the first post-operative day. A final 16 Fr urethral catheter is placed and removed in 2 weeks (Fig. 31.15) [22].

The advantage of the lotus petal flap technique is the utilization of a flap of tissue uninvolved by the original disease process, and with preservation of a perforating vessel, it maintains a rich vascular pedicle permitting the use of a larger swathe of tissue compared to the 7-flap technique. This approach is also flexible with regards to modifying

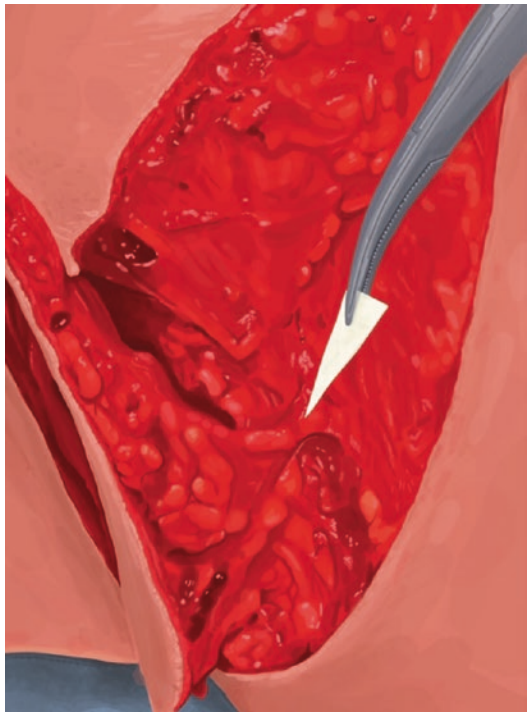

Fig. 31.13 Lotus Flap PU: Elevation of flap and identification of perforator vessel

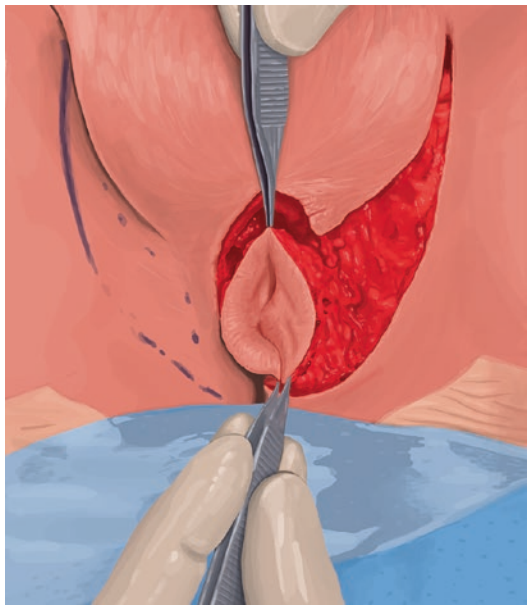

Fig. 31.14 Lotus Flap PU: Petal flap completely islanded and tubularised

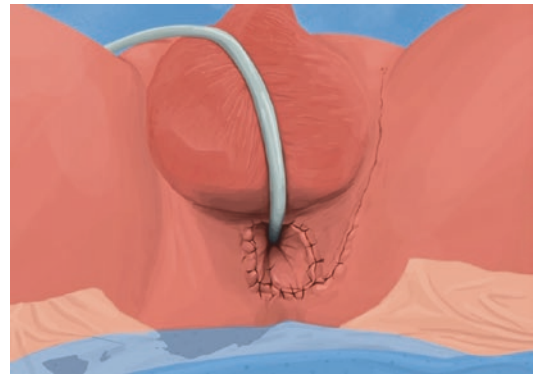

Fig. 31.15 Lotus Flap PU: Final result of the lotus petal flap perineal urethrostomy at the end of operation

the orientation of the flap to suit the defect appropriately. The lotus petal flap is especially advantageous in individuals with very proximal urethral stricture disease or those who are very obese, as it serves to bridge the gap between the urethral defect and perineal skin with a vascularized tube. Drawbacks include the challenge of perforator flap dissection which may require assistance by a plastic surgeon as well as the potential for impaired blood supply due to original disease process specifically trauma and radiation.

31.3.2.3 Augmented Perineal Urethrostomy Using a Dorsal Buccal Mucosal Graft (DeLong) [23]

This technique was recently described by DeLong et al. in 2017. Incorporating buccal mucosal graft in the creation of perineal urethrostomy allows to address urethral strictures that extend far into the proximal bulbar or membranous urethra as well as to address patients at high risk of recurrence (e.g. lichen sclerosus or previous radiation). This technique brings the urethrostomy to the skin surface rather than burying a skin flap deep into the perineum as in the other transecting techniques. At the same time the augmentation with buccal graft also reduces the risk of circumferential scarring of the neomeatus as unlike skin it will not contract secondary to the chronic inflammation caused by urine exposure [24].

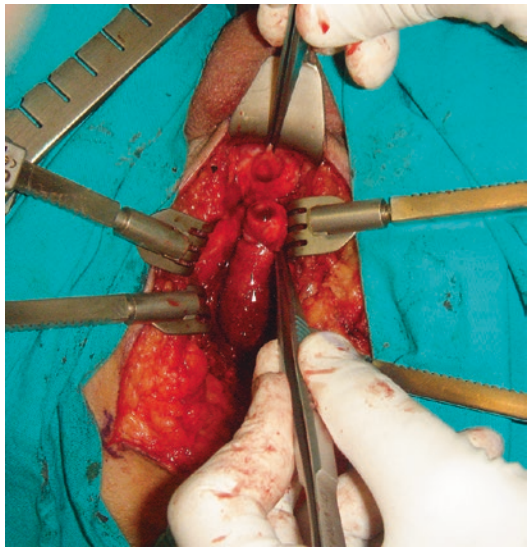

Fig. 31.16 Augmented PU: The corpus spongiosum is dissected and then transected

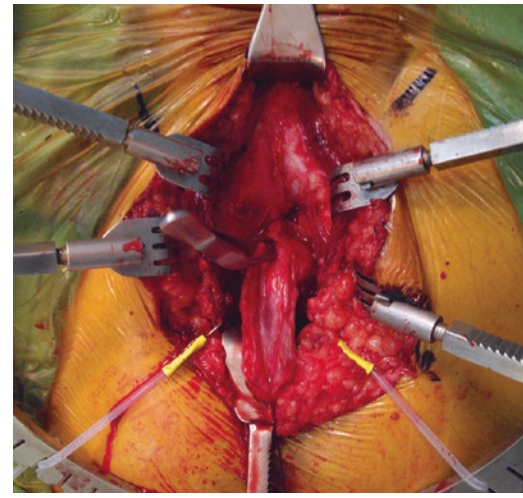

Fig. 31.17 Augmented PU: A dorsal urethrotomy is carried out proximally until healthy mucosa is encountered

The patient is placed in a lithotomy position and an inverted U incision made in the perineum. The bulbospongiosus muscle is divided in the midline followed by mobilization and transection of the corpus spongiosus (Fig. 31.16). The urethra is incised at its dorsal aspect and the incision carried out proximally until healthy mucosa is seen and the lumen can be calibrated to 30F (Fig. 31.17). The distal urethral stump is closed and a fragment of buccal mucosa graft is harvested to fit the dorsal urethral defect. The graft is placed dorsally and anastomosed to the edges of the urethra closing its dorsal aspect. Prior to complete closure, the graft is quilted to the corpora cavernosa (Fig. 31.18) to ensure vasculatization and survival. Cutaneous margins are closed with 4–0 Vicryl sutures, and the remaining wound is closed in layers. A final 14 Fr silicone catheter is placed and removed after 10 days (Figs. 31.19 and 31.20).

31.4 Surgical Outcomes

Reported success rates for creation of a PU range from 70% to 100%. In two series, the success rate of the Johanson technique for creation of a PU in urethral stricture disease approached 75% with a mean follow up of 2–4 years [1, 8]. Success using the Blandy procedure is reported at 70–88% with average follow up of at least 1 year [1, 25], and stratified by the stricture etiology: While patients with prior failed hypospadias repair had better success rates, those with a history of trauma or infection had worse outcomes [1, 9]. Compared to the Johanson technique, improved outcomes with the Blandy technique were reported (74% vs 88%, respectively), although this was not statistically significant. Anecdotally, the Blandy approach is technically easier with regards to maturing the posterior aspect of the urethrostomy [1].

The 7-flap technique was reported as successful in 93–95% of all patients with urethral stricture disease with a mean follow up of 32–56 months [14, 19, 20]. While the lotus petal flap has only recently been applied to use in the creation or revision of PU, this approach was successful in all three patients when utilized for revision (2 patients) or primary (1 patient) PU with follow up of at least 22 months [22]. In summary, PUs can generally be considered to be highly successful with decreased success rates in those

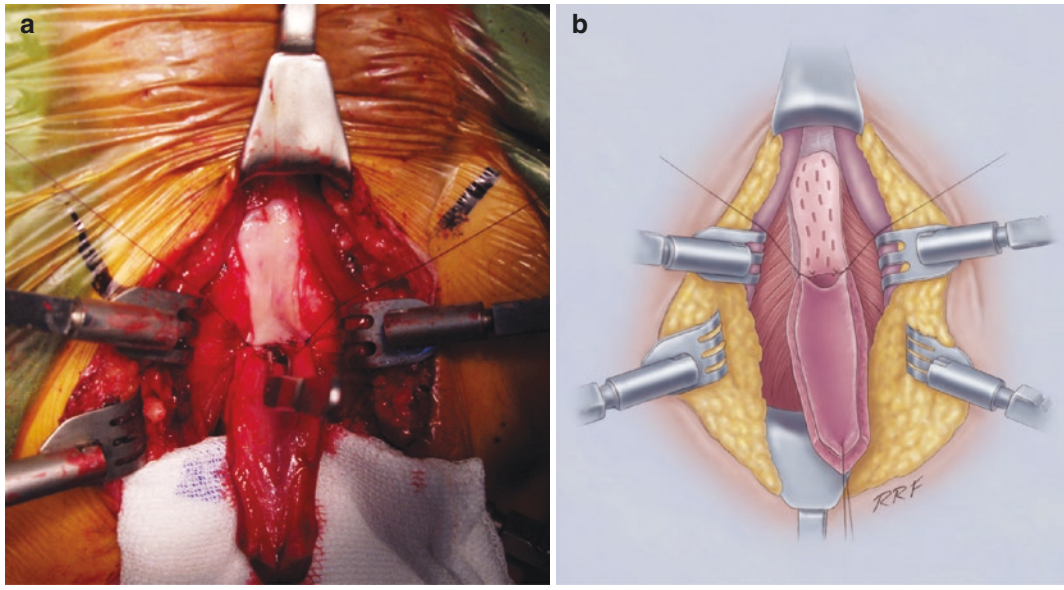

Fig. 31.18 Augmented PU: A buccal mucosa graft is sutured to the urethral margin dorsally and quilted in the graft bed

Fig. 31.19 Augmented PU: Final result at the end of operation

Fig. 31.20 Augmented PU: Final result at 1 month after the operation

patients that comprise a challenge for any kind of reconstruction. DeLong et al. reported an 80% success rate for the augmented perineal urethrostomy with a mean follow-up of 45 months (range 6–136 months) but all patients had complex urethral strictures involving the proximal bulbar or membranous urethra An additional 9% of patients successfully underwent revision with oral mucosa graft and remains recurrence free [23].

31.5 Special Populations

When creating a PU, special considerations should be made in specific populations in order to improve surgical outcomes.

31.5.1 Lichen Sclerosus

Lichen sclerosus represents a highly heterogenous population with variable involvement of the urethra and perineal tissue. Amongst patients with lichen sclerosus, PU success rates range from 72% to 100% [4, 25, 26]. Lopez et al. noted that based on multivariate analysis, individuals with a history of lichen sclerosus were over three-times more likely to require re-intervention following PU creation than those with stricture disease due to failed hypospadias repair or idiopathic etiology [27]. One potential reason for poor success rates in this population is related to possible disease recurrence at the neomeatus. In order to mitigate this, DeLong et al. utilized a dorsal onlay buccal mucosal graft to bring the urethrostomy to the surface of the perineum decreasing anastomotic tension and to prevent circumferential scarring of the urethrostomy. Amongst patients with lichen sclerosus, the authors reported an 80% success rate with a mean follow-up of 45 months [23]. It should be noted that the 2% malignancy risk reported to be associated with lichen sclerosus is not negated by generation of a PU, and malignant transformation of biopsy-proven lichen sclerosus at the PU site has been reported [28].

31.5.2 Obese Patients

In patients with a long skin-to-urethra distance, it can be challenging to achieve a tension-free anastomosis when maturing the urethrostomy. Transecting techniques allow a better mobilization of the proximal urethral stump and, using a local flap such as the 7-flap or lotus petal flap, also allow for custom tailoring of the flap to facilitate a tension-free anastomosis. In two studies, use of a 7-flap in obese patients was 93–96% successful thus similar to the success rates in non-obese patients [14, 19, 20].

31.5.3 Prior Pelvic Radiotherapy

Patients with prior pelvic radiotherapy were reported by Myers et al. to have a 12-fold increased risk of PU stenosis on multivariate analysis attributed to a known predisposition for developing scar tissue formation and poorer wound healing. Despite this risk, the authors still recommend PU creation in this setting due to the absence of a viable alternative and overall success with secondary treatments such as urethral dilations or PU revision. The authors do emphasize that these patients should be managed using a non-transecting technique in order to preserve retrograde blood supply to from the dorsal penile artery [11].

31.5.4 Fournier's Gangrene

Patients with a history of Fournier's gangrene are another challenging population for the reconstructive urologist. The condition leads to obliterated tissue planes and irregular vascularity of the perineum, and as such, local tissue flaps are unreliable and should be avoided. Regardless of approach used, success is poor, and even with the use of a dorsal onlay buccal mucosa graft in one cohort two of three patients failed [23]. However, PU may be the only other option short of suprapubic tube or supravesical diversion and should be considered.

31.6 Surgical Pearls, Complications and Pitfalls

To improve the chance for success several points should be considered either pre- or intra-operatively.

The presence of some healthy proximal bulbar urethral tissue should be identified during preoperative work-up because if the stricture extends too proximally the risk of failure is increased due to tension at the matured urethrostomy. Although this holds true for all techniques, knowledge of a variety of techniques including those designed to bring the skin to the urethral stump (e.g. 7-flap, Lotus-flap) or to lengthen the stump (augmented PU) to decrease the tissue tension is therefore recommended.

Whenever a flap is created (Blandy, 7-flap, Lotus flap) it is important to allow enough length to avoid tissue tension at point of anastomosis as well as to use a broad-enough base (minimum 3:1) to avoid necrosis of the apex of the flap.

Using a wire placed though the strictured area allows for a more precise urethrotomy and helps to preserve quality of the tissue possibly needed for reconstruction while also decreasing tissue trauma that will negatively influence wound healing. If the urethra is obliterated, passage of a flexible cystoscope or an 18F van Buren sound through the suprapubic tract and into the proximal urethra can help in identifying the lumen and minimize trauma ("cut to the light").

The urethrotomy should be extended proximally to allow passage of 30F sound ensuring adequate caliber of healthy proximal urethra even if the stump becomes short, and finally, the use of interrupted anastomotic sutures allow to decrease the tension of the anastomosis between flap and urethra.

However, as previously noted, PU failure can occur in up to 30% of cases requiring re-intervention. Risk factors for failure include a persistent or recurrent disease process (such as lichen sclerosus or urethral cancer), wound infection, undue tension at the anastomosis, or inadequate caliber of the proximal urethral stump. Additionally, patients with a history of radiotherapy, traumatic or infective etiology to stricture, or prior failed urethroplasty should be considered at higher risk for failure [22].

The most common complication encountered is stenosis of the neomeatus, and this can be a difficult condition to manage. If stenosis is mild, the patient may be taught to perform intermittent self-dilation of the neomeatus. In more severe cases of stenosis, the PU may be recreated or revised using a variety of techniques. If available, local skin flaps can be incorporated in the PU (Blandy, 7-flap, Lotus petal flap [9, 11, 29]) or as a Y-V advancement flap [30]. However, if the patient is deficient of healthy local skin (such as in the setting of perineal recurrence of lichen sclerosus, Fournier's gangrene, or extensive perineal trauma) alternative tissue may be utilized as grafts. Kamat et al. describe a composite stoma formed by incising the PU stomal opening at 4-o'clock, 7-o'clock, and 12-o'clock, forming a "cloverleaf" appearance, with placement of three triangularly shaped buccal mucosal grafts into these raw areas. In this series, three of four patients had successful repair at up to 36 months follow up while one remaining patient required monthly self-dilation but no surgical revision [24].

In the setting of multiple prior urethroplasty procedures, ample buccal mucosa may be unavailable for use in stomal revision. To address this, Lumen et al. described the use of a meshed split-thickness skin graft to reconstruct a urethrostomy in a patient with a history of an obliterated PU following treatment for penile cancer which remained patent at 6 months follow up. The main advantage of this graft material is the large availability in those with prior reconstructions; however, as meshed split-thickness skin grafts are prone to retraction it is necessary to broadly spatulate the urethral stump to compensate [31].

Ultimately, if the above techniques fail, the urethral outlet may need to be abandoned altogether with and urinary diversion established. Options are a chronic suprapubic catheter, construction of appendicovesicostomy, or creation of alternative reservoir (e.g. ileal conduit) with or without simple cystectomy.

31.7 Patient Reported Outcomes

In appropriately selected patients, the overall satisfaction following PU is generally excellent. In one large study analyzing patient sat-

isfaction in 173 patients with urethral stricture disease undergoing PU as part of a staged procedure between 1978 and 2007, Barbagli et al. reported that 73% of patients declined to undergo the second stage of urethroplasty; in addition, 97% were satisfied or very satisfied with the results of PU at a median 6 years follow-up and would undergo the procedure again. In this cohort, 84% of patients also noted no psychological, voiding-related, or sexual problems caused by the PU, despite an overall failure rate of 30% requiring one to five further procedures. In addition, 82% of the cohort denied problems with their partner related to PU and notably, patient satisfaction was not influenced by patient age [9].

PU may not be an acceptable option in some patients related to religious, hygienic, cultural or psychological reasons. Specifically, voiding in a sitting position as well as changes in sexual function may be problematic for patients. However, Murphy et al. recently reported that PU does offer improvement in obstructive symptoms without affecting sexual health, and, when adjusting for stricture complexity, offer comparable patient satisfaction to those undergoing anterior urethroplasty [32]. Additionally, Barbagli et al. have noted that many patients with complex urethral stricture already are accustomed to voiding in a seated position due to age and/or voiding difficulty, and so the transition to a PU is not as difficult in practice as it may be conceptually [9].

31.8 Conclusion

Creation of a PU offers a simple, highly successful option in the management of an exceedingly complex condition and should not be viewed as last resort or even defeat. PUs are being increasingly utilized due to an increasing awareness of the limitations of tissue transfer, a better understanding of the disease course, and, perhaps most importantly, excellent patient satisfaction with the outcome.

Key Summary Points

- Creation of a perineal urethrostomy is indicated in the treatment of panurethral strictures and complex anterior urethral strictures. Patients in these populations typically have a long history of urethral instrumentation and reconstruction. Despite being offered complex urethral reconstruction, some patients may prefer perineal urethrostomy due to treatment fatigue. PU creation is also indicated for urinary diversion in penile and urethral malignancies.
- PU is relatively contraindicated as sole procedure in patients with bladder neck contracture or coexistent proximal urethral stenosis, and should be avoided in men with urinary incontinence.
- Non-transecting techniques such as the Johanson and Blandy approaches facilitate retrograde blood flow from the dorsal penile artery and may prevent stenosis of the neomeatus.
- Transecting techniques such as the 7-flap, the lotus petal flap, and augmented perineal urethrostomy can help to achieve a tension-free anastomosis in patients with a longer skin-to-urethra distance such as obese patients.
- Overall success rates for PU creation range from 70–100%, with patients with a history of radiation and lichen sclerosus experiencing increased failure rates. Patients with a history of hypospadias may have better outcomes than those with other stricture etiologies.
- Patient satisfaction is generally high with the perineal urethrostomy.

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