Review Article on Surgical Management of Stress Urinary Incontinence in Men

Urinary symptoms after genital gender-affirming penile construction, urethral lengthening and vaginectomy

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Abstract: Transgender and non-binary (TGNB) individuals are seeking penile reconstruction in greater numbers; many pursue urethral lengthening surgery with a goal of voiding while standing. Changes in urinary function and urologic complications—i.e., urethrocutaneous fistulae and urinary stricture—are common. Familiarity with presenting symptoms and management strategies for urinary complaints after genital gender-affirming surgery (GGAS) can improve patient counseling and outcomes. We will describe current gender-affirming penile construction options with urethral lengthening and review associated urinary complications that present as urinary incontinence. The incidence and impact of lower urinary tract symptoms after metoidioplasty and phalloplasty are poorly characterized due to limited post-operative follow-up. Post-phalloplasty, urethrocutaneous fistula is the most common urethral complication, ranging in incidence from 15–70%. Assessment of concomitant urethral stricture is necessary. No standard technique exists for management of these fistula or strictures. Metoidioplasty studies report lower rates of stricture and fistula, 2% and 9% respectively. Other common voiding complaints include dribbling, urethral diverticula and vaginal remnants. History and physical exam in the post-GGAS evaluation require understanding of prior surgeries and attempted reconstructive efforts; adjuncts to physical exam include uroflowmetry, retrograde urethrography, voiding cysto-urethrogram, cystoscopy, and MRI. Following gender-affirming penile construction, TGNB patients may experience a host of urinary symptoms and complications that impact quality of life. Due to anatomic differences, symptoms require tailored evaluation which can be done by urologists in an affirming environment.

Keywords: Gender affirming surgery; urinary symptoms; voiding; urethral complications

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Introduction

Transgender and non-binary (TGNB) individuals are seeking genital gender-affirming surgery (GGAS) in greater numbers. In order to provide adequate post-surgical care to GGAS patients, we must understand reconstructed anatomy to recognize and assess the unique sequelae associated with these procedures. Common GGAS options for patients assigned female at birth (AFAB) include: metoidioplasty and/or phalloplasty with or without urethral lengthening, scrotoplasty, placement of a penile and/or testicular prosthesis, and often includes a vaginectomy (colpectomy).

TGNB individuals who pursue any form of urethral

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lengthening surgery often do so with a goal of voiding while standing without an external device. Historical data suggest that the majority of transmasculine individuals feel this is a priority to their surgical affirmation (1-4). Changes in urologic function and urologic complications (i.e., urethrocutaneous fistulae and urethral stricture) are unfortunately common and may present as urinary leakage (1,5-8).

Familiarity with presenting symptoms and management strategies for post-GGAS urinary complaints can improve patient counseling and outcomes. Herein, we will describe current GGAS options with urethral lengthening and review the associated urinary complications that present as urinary incontinence.

Baseline urinary dysfunction in the setting of transphobia

Regardless of transition status, TGNB patients experience significant barriers to medical care and are particularly vulnerable to acts of harassment and violence leading to poor mental health; these can be exacerbated by the lack of safe restroom access which can further be associated with stress-related conditions and episodes of urinary tract infections (UTIs) and pyelonephritis (9). Transgender patients may avoid public restrooms altogether and develop dysfunctional voiding habits as a result. Transgender men are 50% more likely to avoid public restrooms when compared to transgender women and non-binary people according to the 2015 US Transgender Survey. This survey also reported that nearly 25% of respondents were questioned in a restroom, 10% denied access to a restroom, and 12% were harassed, attacked, or assaulted (9). Such experiences may start at a young age, and provide important context for urologists who are evaluating urinary symptoms in their TGNB patients (10).

Creating an affirming environment for urologic care

TGNB patients report an array of factors that limit access to high quality healthcare, including prior negative experiences with healthcare providers and feeling responsible for "educating" their providers on their medical needs (11). Seeking urologic care also presents challenges given the "gendered" genitourinary anatomy and sensitive exams that may be triggering for TGNB patients. Adopting trauma-informed care approaches is therefore necessary (12). This includes preparing a patient for what occurs during an exam and involving the patient in their physical exam as well as providing chaperones for physical exams (10). Disseminated training and awareness of TGNB patient needs also includes appropriate communication (e.g., chosen names, pronouns) throughout all mediums (e.g., charted notes, letters to providers). Further provision of care requires familiarity and comfort assessing patient anatomy, understanding that not all TGNB patients elect the same medical and surgical transition, and still often seek care for general urologic issues (e.g., nephrolithiasis, gross hematuria, voiding complaints) (10,11). Clinicians should include an "organ inventory" or "anatomy inventory" and prior relevant surgical procedures in the electronic health record; this entails documenting a patient's current anatomy, uncoupled from their gender identity, assigned sex, or pronouns (i.e., documentation of whether a patient has testes, prostate, vagina, cervix, uterus or ovaries, among other organs). Use of organ inventories allows providers to remain updated regarding risk factors and diagnoses related to anatomy, facilitates relevant screening exams and diagnostic testing, and can facilitate taking a thorough sexual history (12-14).

Metoidioplasty

Metoidioplasty utilizes the clitoris and existing genital tissue to create a neophallus, preserving natal erogenous sensation. Patients on testosterone will experience varying degrees of clitoral virilization and growth. Post-operative phallic length and visibility are difficult to estimate at time of consultation and often are limited by body fat distribution. When accompanied by urethral lengthening, patients may be able to void while standing; several series report 87–100% success with standing to void, though this is difficult to predict preoperatively (5,6,15). Patients may elect to undergo metoidioplasty without urethral lengthening, scrotoplasty or vaginectomy ("simple metoidioplasty"). Unlike phalloplasty, metoidioplasty is often of insufficient length or girth to be used for penetrative intercourse (7) though this is contended in larger comparative reviews (16). Metoidioplasty purports a high aesthetic satisfaction and maintains erogenous sensation. Compared to phalloplasty, metoidioplasty boasts an overall lower complication rate (1,16).

Several metoidioplasty techniques have been described (5,17-21). At our center, most patients undergo a modified Belgrade-style metoidioplasty with urethral lengthening

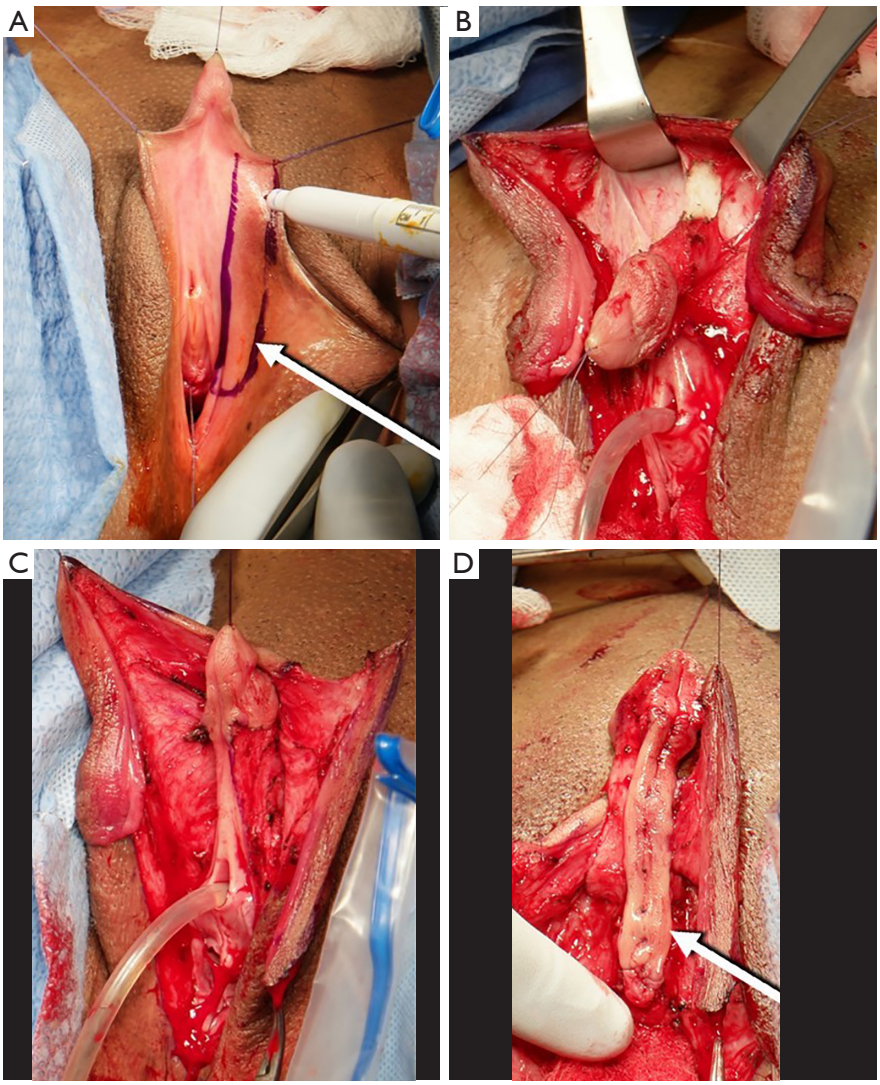

Figure 1 Metoidioplasty. (A) Surgical markings with arrow (white) showing medial aspect of the labia minora which will be overlaid for ventral phallic skin coverage. (B) The clitoris is then degloved via a circumcising incision and the superficial suspensory ligament is divided, releasing the clitoral shaft from the pubic symphysis and allowing for maximal visible phallic length. (C) The urethral plate prior to division. (D) Division of the urethral plate with arrow (white) demonstrates buccal mucosa graft for dorsal onlay urethroplasty.

(17,18). Our approach begins with vaginectomy, performed using sharp excision of the vaginal mucosa. Colpocleisis ensures closure of the paravaginal space and a distal anterior vaginal wall flap, based at the meatus, is maintained for use during urethroplasty. Cystoscopy assesses for ureteral obstruction and suprapubic tube placement allows for urinary diversion. The clitoris is then degloved via a circumcising incision, with division of the superficial suspensory ligament, releasing the clitoral shaft from the pubic symphysis and allowing for maximal visible phallic length (*Figure 1*). Ventrally, the clitoris is separated from the labia minora and the urethral plate is divided. Typically, the ventral defect measures 3–5 cm. A dorsal onlay urethroplasty using buccal mucosa graft (BMG) reconstructs the urethral plate. The anterior vaginal wall flap is rotated anteriorly and sutured in place to begin the ventral urethral reconstruction. Labia minora flaps are mobilized and one flap is used for ventral urethroplasty, de-epithelialized laterally, while the contralateral flap is de-epithelialized medially and overlaid for ventral phallic skin coverage. The urethroplasty is tubularized to an approximately 16 Fr urethra, typically resulting in a hypospadic meatus at

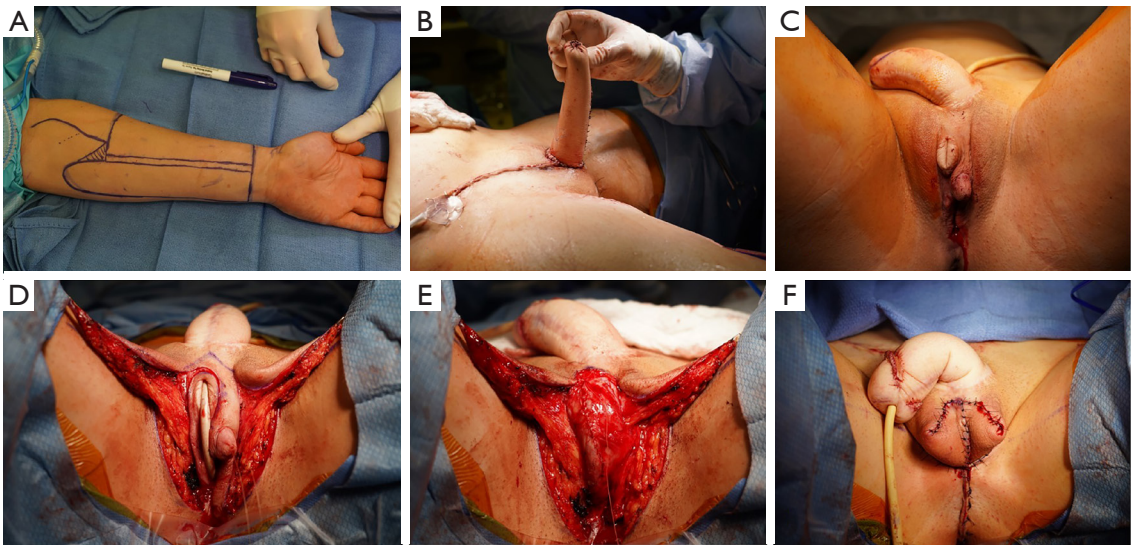

Figure 2 The Big Ben method is a staged approach to phalloplasty. Stage one of the Big Ben method includes microsurgical phallus creation. Preoperative markings are depicted (A). At the completion of stage 1 (B), the urethral inset of the phallic urethra extension is seen at the location of the labia minora, which has been resected (C). Panel C is at time of stage 2, after vaginectomy and suprapubic tube placement. The urethral lengthening (D,E) and multi-layered closure are followed by scrotoplasty, glansplasty, and perineorrhaphy (F).

the base of the glans. The urethral catheter is removed postoperatively to avoid excess tension on the reconstructed meatus. Scrotoplasty, perineal and skin closure are then performed (17).

As an alternative to metoidioplasty with graft urethroplasty, surgeons may reconstruct the urethra utilizing the epithelium of the bilateral inner labia which are tubularized to create the ventral and dorsal urethra ("ring metoidioplasty") (19,20). Modifications to the ring metoidioplasty have been described to avoid use of vaginal flaps and decrease urethral complications (21).

Phalloplasty

Phalloplasty represents a complex series of reconstructive procedures each with unique considerations and potential complications. The extensive reconstruction is a combination of phallic shaft creation, penile urethroplasty, perineal urethral lengthening, perineoplasty, scrotoplasty, and glansplasty. Staged placement of testicular implants and erectile devices can occur after ensuring appropriate phallic healing. Technical variations allow for shaft-only phalloplasty followed by vaginal-preserving vulvoscrotoplasty without urethral lengthening (22,23). The neophallic urethra is constructed to elongate the native urethra, extending to the fixed perineal urethral (i.e., pars fixa), where an anastomotic urethral segment extends to the phallic urethra (i.e., pars pendulans) (8). The most frequent surgical design for the phallic urethra is the tube-within-a-tube, consisting of two skin edges that are rolled in opposite directions with a short section between the two surfaces which is de-epithelialized to allowed for tubularization (24). Common donor sites include radial forearm free flap (RFFF) and the pedicled anterolateral thigh (ALT) (8,24). Combination flaps utilizing RFFF and ALT for the shaft and urethra are also possible.

As with the variety of surgical techniques and shaft donor sites, there exist multiple opinions regarding single-stage versus staged procedures. At our institution, we utilize the Big Ben staged approach to phalloplasty (*Figure 2*), separating the microsurgical phallus creation from the urethral reconstruction (25,26). This method requires the phallic urethra extension from the phalloplasty be brought inferiorly, whereas other methods often recreate the urethra superiorly from the constructed bulbar urethra. In the Big Ben method, the unilateral area of skin between the labia minora and majora will become the superior aspect of the bulbar urethra at a second stage. Typically 5–6 months after the first stage, the second stage consists of a vaginectomy followed by urethral lengthening,

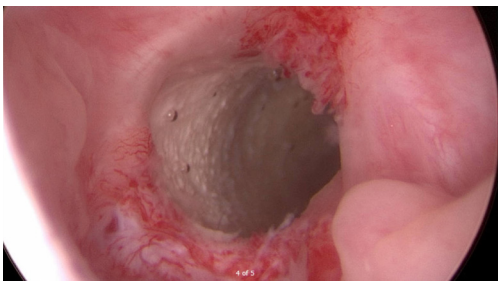

Figure 3 Cystoscopic surveillance after urethroplasty demonstrated granulation tissue at the repair site. Granulation tissue may contribute to obstructive voiding symptoms.

scrotoplasty and glansplasty. Multiple layers of closure are possible over the urethral construction except for the native-urethra-to-phallic-urethral anastomosis where fewer layers of tissue are available (25-27). The Big Ben method is of particular utility given the reported 3–11% flap loss, leaving the patient with unaffected urinary drainage and ability to void from the native urethra while the phallic flap is monitored (25,27).

Vaginectomy

Vaginectomy, also known as colpectomy, reduces the risk of urethral complications with GGAS (28-30). Colpectomy can be performed together with hysterectomy or at the time of creation of the perineal to phallic urethral anastomosis during GGAS (31,32). At our institution, we prefer to perform colpectomy at the time of phallic urethral anastomosis. The procedure itself may be performed as either a mucosal ablation via a vaginal approach or epithelial excision through a robotic-assisted trans-abdominal or vaginal approach. Superficial fulguration of the vaginal mucosa with electrocautery is faster and easier than excision with less blood loss, but is associated with risk of vaginal remnants which may require subsequent surgical intervention (5,8,33). Abdominal approaches are typically laparoscopic or robotic-assisted laparoscopic techniques (33-35). The vaginal lining is mobilized with sharp dissection. In both fulguration and excision, the remaining cavity is closed with serial purse-string sutures utilizing lateral musculature to create a narrowed genital hiatus (36). While long-term continence outcomes remain lacking from this postoperative population, minor complications frequently reported include UTI, urinary retention, and pelvic floor dysfunction (31,36).

Evaluation of post-GGAS incontinence

History and physical exam in the post-GGAS evaluation requires understanding of prior surgeries and any attempted reconstructive efforts. Common complaints of dysuria, straining, weakened stream and inability to void should be noted. Patients who present with post-surgical urinary incontinence may complain of other storage symptoms such as frequency and urgency. History of prior or recurrent infections should be noted and treated, particularly when symptoms exist concurrently. In-office uroflow and post-void residual (PVR) bladder scan will provide data regarding patient emptying and assess for overflow incontinence. This is compared with the PVR obtained during pre-operative evaluation. Retrograde urethrography and/or voiding cysto-urethrogram with cystoscopy delineate anatomic concerns described later (37). History of prior reconstructive attempts may suggest existence of granulation tissue which can contribute to obstructive lower urinary tract symptoms and can be seen on cystoscopy (*Figure 3*) (38,39). In our experience, suprapubic tubes placed at the time of a urethral lengthening procedure are routinely maintained for three to four weeks, and up to six weeks if needed for urethral healing; however in a patient with a history of prolonged catheterization, bladder calculi should be considered as a potential source of urinary symptoms. Lastly, perioperative bowel habits should be assessed and treated to prevent ongoing negative bowel-bladder dysfunction.

On cystoscopy, common benign findings may include hair in the phallic urethra, tortuosity of the perineal urethra, presence of Skene's glands ostia, and presence of a small wide-mouthed diverticulum inferior to the bladder neck, which should be distinguished from clinically significant diverticulae which may be narrow-mouthed and large. Due to urethral tortuosity, blind passage of a standard Foley catheter may be difficult. We prefer use of a 14-Fr coude catheter, and if unsuccessful after one pass, use of a flexible cystoscope with guidewire to place a catheter. If these steps fail to narrow down a differential diagnosis, urgency incontinence should be evaluated with trial of appropriate behavioral and/or medical therapy, or further investigation (i.e., urodynamic studies). Urgency incontinence in the absence of obstruction should be treated according to AUA Guidelines (38).

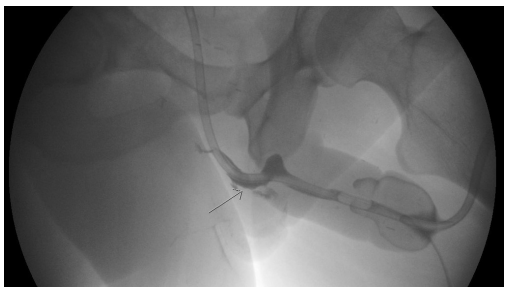

Figure 4 Retrograde urethrogram performed alongside a catheter demonstrates contrast traversing a urethrocutaneous fistula of a phalloplasty patient (arrow).

Urinary symptoms and complications

Incidence of urinary symptoms after GGAS

Few prior studies have assessed change in lower urinary tract function after GGAS (40,41). In Hoebeke's cohort, 92 transgender men who had undergone a phalloplasty procedure demonstrated no difference in uroflowmetry pre- and post-GGAS (40). Questionnaires administered to the cohort revealed the majority of patients (68%) denied any voiding changes after phalloplasty (40). Veerman *et al.* studied both metoidioplasty and phalloplasty patients in a 63-patient cohort who received pre- and post-GGAS voiding questionnaires with no reported difference in voiding patterns (41). No difference in uroflowmetry was again noted (40,41). However, these findings are limited by sample size (only 25 patients had pre- and post-op questionnaires and 35 had pre- and post-op uroflowmetries) and the phallic constructions were not differentiated (though only 8 patients in the study underwent metoidioplasty) (41).

Patients may have an increased risk of developing micturition disorders due to disruption of the surrounding pelvic floor musculature following vaginectomy, leading to new reports of overactive bladder and stress urinary incontinence (42). Levator spasm as a result of surgical reconstruction may lead to pain and voiding changes (43). Surgical remedies for post-GGAS stress incontinence, for example, are not well studied and limited to case reports (44,45).

Ultimately, the incidence and impact of lower urinary tract symptoms after metoidioplasty and phalloplasty is poorly characterized due to limited post-operative follow-up. Patients may present to surgeons other than their primary surgeon with their urinary complaints. Retrospective review of a cohort of 55 GGAS patients with urinary complications revealed that within a median of four months of surgery, nearly 75% of patients presented with two or more complications: 86% strictures and 56% fistulae (46). Many patients travel long distances for their initial GGAS (47), therefore this is relevant for urologists across the country (48).

Strictures and fistulae

Phalloplasty

Urethral strictures often occur at areas of ischemia and hence develop most commonly at the anastomotic junction between the perineal and phallic urethra, or along the length of the phallic urethra (49). Interventions for strictures range from temporary catheter dilation, endoscopic dilation or direct visualization internal urethrotomy (DVIU) with or without steroid injection, to urethroplasty. DVIU or dilation are less invasive options for short, single strictures (49), however the rate of recurrence is high–nearly 90%–due to lack of vascular corpus spongiosum (50). Urethral reconstruction is often the most definitive management strategy. Though no technique has been applied as a standard, staged urethroplasty for strictures throughout the urethra have the lowest reported rates of recurrence, approximately 30% (39,49,51). Excision and primary anastomosis of urethral segments is discouraged due to high recurrence rates (8,50). Perineal urethrostomy remains an alternative for patients who elect to forego reconstruction or have failed multiple prior reconstructive attempts.

Post-phalloplasty urethrocutaneous fistula is the most common urethral complication, presenting as leaking of urine from the skin along the ventral phalloplasty suture line, and ranging in incidence from 15–70% (52) (*Figure 4*). The most common location is at anatomic sites between phallic and perineal urethra (roughly the area of the base of phallus to penoscrotal junction) and in the ventral suture line between perineal and native urethra (53). Assessment for potential co-existing stricture is necessary.

Spontaneous closure of fistulous tracts has been reported within 2–4 months of diagnosis (8,39). Repair requires complete excision of the fistula tract with multilayer closure and non-overlapping suture lines. Ensuring that no distal obstructive process exists is critical. Flap interposition, including fasciocutaneous groin, labial fat pad, or musculofascial gracilis, can decrease recurrence (30,54,55).

Attempts to reduce the rate of stricture and fistula have all utilized vascular tissue flaps in order to bolster

closure. Massie *et al.* reported 2.5-fold reduction in risk of stricture when using vestibular tissue or bulbospongiosus flaps at time of urethral reconstruction during phalloplasty compared to those patients without the flaps (30). A similar series reported a vaginal labia minora flap "wrap" resulting in a 15% decrease in stricture rate (56). Use of gracilis muscle interposition has been reported in RFFF phalloplasty in a small study with no reported fistulas (a decrease from 63% fistula rate prior to intervention) (54,55).

Phalloplasty can also be performed after prior metoidioplasty, either as part of a planned staged procedure or as a result of patient dissatisfaction with a metoidioplasty alone. A multi-center case series by Al-Tamimi *et al.* demonstrated that transgender men who underwent a secondary phalloplasty often indicated desire for a larger phallus to facilitate penetrative intercourse (69% of the cohort) compared to facilitating voiding while standing (18%) (57). Nearly 40% of patients developed urethral strictures and 30% developed urethral fistulas, with a majority of complications reported along the phallic urethra (57).

While gender-affirming phalloplasty is associated with quality-of-life improvement, data regarding aggregate outcomes is sparse. Remington *et al.* compared phalloplasty in cisgender male patients to transgender male patients in a large meta-analysis that identified a urethral complication rate of nearly 40% compared to 25% in cisgender male patients (P<0.0001); this finding was accompanied by a 79% rate of standing to void in transgender male patients compared to 89% in cisgender male patients (P=0.001) (58). These findings underscore the need for deliberate study of surgical technique, rate of complications, and ongoing patient education regarding surgical risks.

Metoidioplasty

The largest cohort of metoidioplasty is reported from Bordas *et al.* with over 800 patients spanning over 14 years (5). This group treated 813 transgender men with a single-stage metoidioplasty and reported a 90% complication-free rate, identifying an overall 9% fistula and 2% stricture rate. Due to the size of the cohort and the longitudinal data collection, this group assessed their varying techniques of urethral lengthening, which included tubularization alone (n=92), onlay flap (n=42), BMG with clitoral skin (n=83), BMG with labia minora flap (n=537), and labial skin flap grafting (n=59). Among these groups, the fistula rate ranged from 8–14% (overall cohort n=72, 9%) (5). Bordas *et al.* found the BMG and labia minora flap combination to have the lowest complication rate overall and therefore considered this their standard, which supported a previous study (18) comparing BMG with labia minora flap to BMG with dorsal clitoral skin (5). In this earlier cohort, the authors reported minor postoperative complaints of dribbling and spraying of urine in approximately 30% of patients accompanying a fistula rate of 6% in the BMG and labia minora flap group (*vs.* BMG with dorsal clitoral skin, 14%, P<0.05). At our institution, we have seen one post-metoidioplasty urethral stricture requiring treatment with BMG and no fistulae requiring surgical intervention.

Modifications to the metoidioplasty have been described to decrease rates of stricture and fistula. Meltzer and Esmonde described their experience with ring metoidioplasty, reporting a 6% stricture and 1% fistula occurrence rate in their series of 91 patients with a resultant success of 88% (80 patients) defined as patients endorsing standing to void with an adequate stream (21). In this series, the fistulae spontaneously resolved without intervention. All five patients with strictures required surgical intervention: two with BMG urethroplasty and three with single urethrotomy followed by self-intermittent dilation. No longer-term follow-up of these patients has yet been reported (21). Another series of retrospective ring metoidioplasty outcomes demonstrated an incidence of 13% (n=7) of urethrocutaneous fistula and a stricture rate of 8% (n=4) in a 51 patient cohort (17). Among these, one urethrocutaneous fistula resolved spontaneously wherein eight remaining patients underwent fistula repair and/or urethroplasty (20).

In an attempt to better anticipate the need for surgical revision, some surgeons propose second stage metoidioplasty as an opportunity to repair urethral complications and to address aesthetic concerns, including placement of scrotal implants, repair chordee or phimosis (59). Despite surgical technique differences or modification to surgical interventions, surgeons are also investigating patient-modifiable risk factors. The importance of nicotine cessation cannot be stressed enough in any reconstructive procedure; nicotine was found to be a significant predictor for urethral complications in a systematic review by Waterschoot *et al.* (60). This analysis did not demonstrate body mass index (BMI) as an independent predictor of urethral complications. Concomitant vaginectomy was assessed as a risk factor given the risk to the bladder and rectum during the vaginectomy portion of the surgery, but this did not demonstrate increased

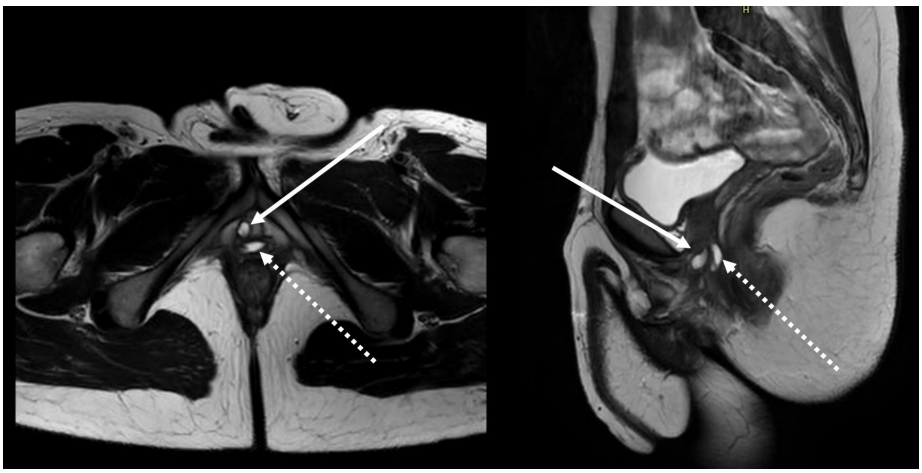

Figure 5 MRI demonstrating Skene's gland cyst (white solid arrow) and vaginal remnant (white dotted arrow) in a patient who underwent metoidioplasty with subsequent secondary phalloplasty and vaginectomy.

Figure 6 MRI pelvis in a patient with a large mucocele (white arrow).

independent risk either (60).

Dribbling

A common complaint after phalloplasty is post-void dribbling; the phallic reconstruction does not have tissue analogous to the bulbospongiosus muscles to aid in urine expulsion. Patients must then manually express the urine out to their meatus; often patients refer to "milking" or "massaging" urine from the mid-perineum extending along the length of the penis after urination (61). Despite adequate compression, some urine may remain in the urethra and is especially the case in larger reconstructions (i.e., ALT) (24).

Urethral diverticulae and vaginal regrowth

Urethral diverticulae at the level of the perineal urethra may be asymptomatic if small, or if larger may lead to increase in post-void dribbling, pelvic pain, or recurrent infections (24). These should be distinguished from a persistent vaginal cavity or regrowth of the vaginal canal, which may present as prolonged and high-volume post-void dribbling, pelvic or perineal pain or fullness, "perineal cysts," and urinary tract infections (5,62). These remnants may communicate with the urethra, forming essentially a urethral diverticulum through the associated urethrovaginal fistula, or may not communicate with the urethra and be a mucocele. Urologic evaluation should include assessment for urethral stricture, as distal obstruction may transmit pressure through the suture lines and into the previously obliterated vaginal canal (50). MRI is often helpful at diagnosing remnants and demonstrating their size and relationship to surrounding anatomy (63) (*Figures 5*,*6*). Flexible cystoscopy is a useful adjunct in identifying strictures and/or communication between the urethra and the remnant. Incomplete vaginectomy or inadequate de-epithelialization predispose to this condition. Excision and attempt at obliteration of the vaginal remnant can be done through open perineal or transabdominal/robotic-assisted approaches (34) (*Figure* 7).

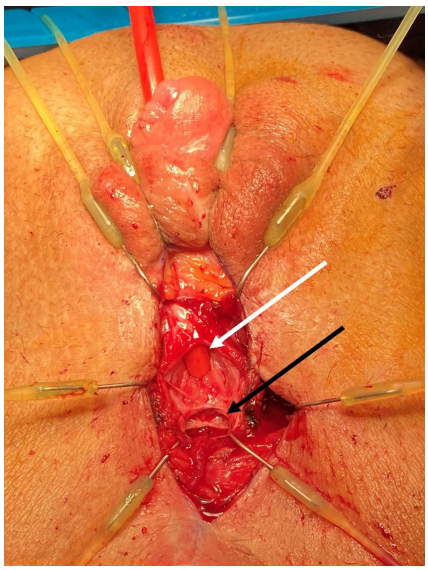

Figure 7 A catheter (white arrow) is seen in the urethra with a vaginal remnant visualized (black arrow) at time of excision.

Conclusions

Following gender-affirming penile construction, TGNB patients may experience a host of urinary symptoms and complications that significantly impact their quality of life. Due to anatomic differences between natal penile anatomy and post-GGAS anatomy, symptoms such as post-void dribbling and urinary incontinence require tailored evaluation. General urologists should understand how to create an affirming environment for urologic care, how to evaluate common lower urinary tract symptoms after GGAS, and indications for referral to a reconstructive urologist who can address surgical concerns.

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