

Feminizing Genital Gender Affirming Surgery

Editors:

Maurice M. Garcia, MD, MAS

Authors:

Christi Butler, MD

Last Updated:

Friday, March 10, 2023

Keywords

Gender-affirming surgery; Penile inversion vaginoplasty; Vulvoplasty; Shallow depth vaginoplasty; Zero-depth vaginoplasty; Peritoneal vaginoplasty; Intestinal Vaginoplasty; Colon vaginoplasty; Neoclitoris; Surgical techniques

Key Points

- Feminizing genital gender-affirming surgery includes a wide range of procedures, including orchiectomy, orchiectomy with scrolectomy, vulvoplasty, and vaginoplasty
- Patient preparation includes mental health, social, and medical evaluation and readiness. Patients must be nicotine-free and be counseled for appropriate expectations of surgical results
- The most common technique for vaginoplasty is penile inversion vaginoplasty, with peritoneal flap vaginoplasty and intestinal vaginoplasty as alternatives
- Individuals who undergo vaginoplasty must be prepared for lifelong vaginal dilation, use of lubrication during intercourse and dilation, and vaginal hygiene maintenance which differ from care of natal vaginas

1. Introduction

Priorities for transgender and gender diverse (TGD) patients seeking feminizing genital gender-affirming surgery (gGAS) may include removal of male-associated genitalia (penis, testes, scrotum) and reconstruction of more feminine genitalia (clitoris, Labia minora and majora). The goal for surgery may include gender affirmation, maintenance or enhancement of sexual and urinary function, increase comfort and safety in public settings, and other benefits. Some (but not all) individuals desiring feminizing gGAS may seek creation of a neovaginal cavity that allows for receptive vaginal intercourse. Goals of surgery vary by individuals' preferences and priorities. It is important to have a full discussion of available surgical options and their risks and benefits, in the context of the patient's medical, surgical, mental health, and social history. The concept of shared decision-making is essential in gGAS as it is in all of medicine.

In this section, we provide an overview of techniques in feminizing gGAS, post-operative pathways,

and management of complications with a focus on penile inversion vaginoplasty.

2. Gender-Affirming Orchiectomy and Scrotectomy

Bilateral orchiectomy can be performed as a stand-alone procedure, before or in lieu of additional genital surgeries.¹ Bilateral orchiectomy offers patients several health and transition-related benefits:²

1. May discontinue anti-androgens (e.g. Spironolactone; eliminates the negative diuretic side effects)
2. May lower their dose of estrogen, typically by about 50%, which lessens any negative cardio-vascular side-effects by estrogen;
3. Gender affirmation;
4. Ability to “tuck” or conceal genitals with greater comfort

When vaginoplasty is delayed (e.g. while the patient undergoes several months of permanent hair removal treatments), offering orchiectomy for the above interval benefits may be considered. Before bilateral orchiectomy, the option to pursue fertility preservation should always be discussed. Patients may experience increased risk of osteoporosis after gonadectomy and should maintain a cross-sex hormone regimen. ³

As a stand-alone procedure, bilateral orchiectomy can be performed via a vertical-midline scrotal incision to minimize risk of compromising tissues necessary for vulvoplasty or vaginoplasty. Bilateral simple orchiectomy is an outpatient procedure and does not require pre-surgery hormone cessation. The surgeon should ensure the patient understands that no scrotal skin is excised during simple orchiectomy unless explicitly agreed upon before surgery. Standalone orchiectomy does not preclude full-depth vaginoplasty at a later date. One group has been found that patients who have undergone prior orchiectomy, are more likely to require an extragenital skin graft for canal coverage during vaginoplasty, though another group found no difference in available scrotal skin for vaginoplasty after prior bilateral orchiectomy.^{3,4} Patients who desire concurrent removal of the scrotum and do not experience dysphoria from their penile anatomy, or prefer penile anatomy for sexual and urinary function, may elect to undergo orchiectomy with simple scrotectomy. These individuals should be counseled that future vaginoplasty will require harvest of non-genital epithelium (e.g. intestinal segments or skin grafts) due to elimination of the scrotal skin, which is commonly utilized to create/augment the vaginal canal.

3. Vaginoplasty

Penile inversion vaginoplasty (PIV) is the most common contemporary technique for vaginoplasty in TGD individuals. In this technique, the penile skin is separated from the deep structures of the penis, and the penile skin flap is inverted into a cavity created between the prostate and rectum. The technique was first described by Gillies and Millard in 1957,⁵ but it was the Moroccan gynecologist Dr. Georges Burou who independently developed the technique and popularized it through his high surgical volume.⁶ Many surgeons have made improvements and modifications over the years.⁷

3.1 Patient selection and eligibility

Patients seeking gender-affirming vaginoplasty must have well documented gender dysphoria and be mentally, physically, and socially ready for surgery. Many surgeons and insurance providers follow guidelines put forth by the World Professional Association for Transgender Health (WPATH). **The WPATH Standards of Care (SOC)**⁸ outline requirements that must be met prior to performing surgical treatment for gender dysphoria, written with the intention of maintaining flexibility in application. These selection criteria are discussed further in the Core Curriculum **Genital Gender Affirming Surgery and Care of Transgender and Gender Diverse Patients** and **Transgender Hormone, Medical Management and Pre-Surgery Preparation of the Transgender Patient**.

The usual concerns of medical fitness for any major surgery apply. However, vaginoplasty is a major reconstructive surgery with tissue transfers that require optimal healing potential and blood supply, more so than for a solely extirpative procedure. Due to the increased risk of tissue necrosis and graft failure in active nicotine users,⁹ patients should cease all nicotine use at least 6 weeks before and after surgery. Some experts recommend confirmatory tests for nicotine and metabolites with preoperative labs. Additionally, chronic anticoagulation may increase the risk of bleeding postoperatively, which can increase the risk of skin graft failure if a hematoma forms beneath a graft.

Surgical site infections and poor healing generally are associated with poor diabetic control.^{10,11} Many experts recommend a hemoglobin A1C of 6.5 as a common upper limit for surgery and strictly adhere to this as poor glucose control is associated with greater risk of local infection and wound complications.^{12,13,14} As any selection criteria, some patients may not be able to reach the threshold that will make them eligible for surgery.¹⁵ In these cases, the relative risk of surgical complications must be balanced against the risk of not providing important, sometimes life-saving, surgical therapy.

Obese patients are at increased risk of peri-operative surgical morbidity from anesthesia, potential positioning injury, and post-operative surgical complications such as wound infection and breakdown.¹⁶ One study found slightly higher wound complication and prolapse rates among patients with a higher body mass index (BMI),¹⁷ however another concluded that BMI is not associated with an increase in complications.¹⁸ BMI limits of 28-35 have been described by some, though these are surgeon-specific and do not include all surgeons. BMI is a population-based metric, and is not always a reliable predictor of body habitus or health status of individual patients.¹⁹ Vaginoplasty, particularly dissection of the neovaginal canal, may be technically more difficult in obese patients.

A patient's prior medical and surgical history may affect if a neovaginal canal may safely be dissected. Patients who have a history of rectal surgery, radical prostatectomy, and/or pelvic radiation²⁰ are at increased risk of injury to the rectum with subsequent recto-neovaginal fistula formation due to scarring in the retro-prostatic space. Additionally, these patients may be at increased risk of urinary incontinence,²¹ from disruption of the urinary continence mechanisms during the dissection. After vaginoplasty, when the proximal corpus spongiosum is no longer available to be encircled by an artificial urinary sphincter, the best surgical options for stress urinary incontinence are

no longer possible. For these reasons, we recommend against vaginal canal construction using local flaps and skin grafts post-prostatectomy or after radiation therapy for prostate or rectal cancer, but instead offer gender-affirming vulvoplasty²² without construction of a neovaginal canal. Vaginal canal construction using peritoneal flaps or the right and transverse colon as a pedicle flap²³ is a consideration among carefully selected patients who accept the risk of permanent urinary incontinence, elevated risk of rectal injury, and the potential that a canal dissection may be terminated intraoperatively if deemed unsafe.

Patients who wish to have a neovaginal canal must be willing and able to perform regular dilation of the neovaginal canal after surgery, most regularly in the first years after surgery (discussed in detail below). Patients must have access to a safe, private area for self-dilation, the physical dexterity and range of mobility to perform dilation, and the dedication to this time-consuming and tedious maintenance regimen. Patients who are unable or unwilling to perform self-dilation should not be considered candidates for vaginal canal construction, as failure to dilate invariably leads to canal stenosis, which itself results in loss of vaginal canal function and limits ability to douche and maintain canal hygiene. Patients who cannot reliably perform dilation and douching may be offered vaginoplasty without creation of a vaginal canal (known as vulvoplasty, “zero-depth” or “shallow-depth vaginoplasty”).^{24,25,26}

3.2 Patient readiness and preparation

Patient Expectations

Setting appropriate patient expectations for surgical outcomes is important for any operation, and this is especially true in gGAS. High expectations of a “natural” appearance, coupled with the general population’s low knowledge level of female vulvar anatomy²⁷ can contribute to unmet expectations after surgery. In an attempt to help educate patients about the wide range of normal vulvar anatomy, at patient consultations and pre-operative visits we give patients two books to peruse while they wait: *The Great Wall of Vagina* by Jamie McCartney (Jamie McCartney, 2011) and *Womanhood: The Bare Reality* by Laura Dodsworth (Pinter and Martin, 2019). Both have pictures demonstrating vulvas from people with a wide range of ages and body types, including transfeminine individuals, to illustrate that every person’s vulva is unique.

Mental Health and Social Support

Vaginoplasty is a major surgery with significant recovery time that typically requires 6-8 weeks off from work. Patients must be medically, socially and emotionally prepared for success. As of September 2022, all genital surgeries now only require 1 letter of assessment and support from a health care professional. Patients sometimes express frustration at perceived “gate-keeping” in requiring mental health evaluation prior to surgery, something that most cisgender patients undergoing surgery are not required to complete. However, it is recommended that patients have previously established access to mental health support in case it is needed postoperatively.⁸

Patients must also have the housing stability and sufficient social support in their activities of daily

living for recovery from a major surgery.

Hair Removal

Scrotal and perineal skin is hair bearing, and full-thickness grafts or flaps that transfer this skin into the neovaginal canal will transfer that skin's hair growth potential as well. Hair growth within the neovagina can be very bothersome for patients and is a common complaint.²⁸ Prior studies have shown that patients are very dissatisfied when neovaginal hair is present postoperatively.²⁹ Efforts to remove hair from the skin that will line the neovaginal space is thus needed. These may include electrolysis or laser hair removal,³⁰ both of which may take several months. Some surgeons prefer intraoperative hair removal or follicular "scraping"— there is limited published literature that describes this technique or assesses the effectiveness of this approach. Furthermore, follicle-scraping cannot be performed on hair bearing penile shaft skin, as this is used as a pedicle flap (follicle-scraping would interrupt the flap's blood supply).

Pelvic Floor Physical Therapy

Creation of the neovaginal canal requires dissection of a path through the pelvic floor muscles and into the pelvis. Patients will then have to learn to control pelvic floor muscle tone (relaxation, contraction) in order to perform neovaginal dilation and to have intercourse postoperatively. This is something many patients express anxiety about. Many people have little awareness of their pelvic floor muscles or their function.²⁸ One study demonstrated a nearly 40% rate of pre-existing pelvic floor dysfunction, which can be significantly improved with pelvic floor physical therapy before surgery.³¹ A growing number of centers are offering perioperative pelvic floor physical therapy to help patients prepare for, and in some cases accomplish, neovaginal dilation after surgery, though this should be done in close collaboration with the surgeon.

Before deciding on whether or not to refer a patient to a pelvic floor physical therapist, it can be especially helpful to teach patients to voluntarily relax their pelvic floor muscles by performing Kegel exercises. A common misconception is that Kegel exercises are solely to exercise muscle contraction and strength. Contraction is only the first half of a Kegel exercise. The second half is voluntary, focused relaxation - precisely what patients benefit from doing in order to insert anything into their vaginal canal (i.e. with performing vaginal dilation, douching, receptive vaginal intercourse), or out of their pelvic floor (first attempts at urination and defecation, post-operatively). Urodynamic studies of patients with voiding dysfunction have shown that Kegel exercises can inhibit uninhibited detrusor contractions (UDC), and, result in greater overall pelvic floor relaxation than when the patient is simply asked to "relax" their pelvic floor.³¹ Biofeedback has been shown to further improve selective control of strength and relaxation during Kegel exercises,³² but Kegel exercises alone are very helpful, and an excellent first-line therapy. Patients can be taught to perform these pre-operatively. We recommend patients perform 50-75 Kegel exercises in repetitions of only 2-3 exercises. When patients first void after surgery, we recommend that they perform 1-2 Kegels immediately before commencing their urinary stream.

Patients can be taught to perform kegel exercises by simply asking them to contract their pelvic floor

muscles around a gloved finger inserted into their rectum (pre-operatively) or their vaginal canal (post-operatively).

Though a pelvic floor physical therapist may certainly be helpful to patients in their quest to learn to better relax their pelvic floor muscles, in our experience, patients undergoing vaginoplasty rarely require referral to a therapist for biofeedback and other interventions.

4. Surgical Techniques

Overview

The most common approaches for vaginoplasty include penile inversion vaginoplasty, with canal construction from a combination of scrotal skin, other skin grafts, peritoneal flaps, or intestine.

4.1 Penile inversion vaginoplasty

The phrase “penile inversion vaginoplasty” generally refers to the technique where at least part of the vaginal canal is made by advancing penile skin into the neovaginal space. General surgical steps are found in **Table 1**, and reflect common practice. Excess scrotal and perineal skin is used as a graft to help line the neovaginal space. While vaginoplasty in total is a complex genitourinary reconstructive procedure, it is a collection of smaller procedures familiar to urologists, in addition to other reconstructive procedures:

1. Simple orchectomy
2. Penile disassembly
3. Perineal exposure of the prostate
4. Perineal urethrostomy
5. Vaginal canal construction with skin grafts, peritoneal flaps, and/or intestinal tissue
6. Clitoroplasty
7. Labiaplasty

Table 1: Surgical Steps of Vaginoplasty with creation of a vaginal canal

Skin incision and early excision of scrotal-perineal skin for graft preparation
Bilateral simple orchiectomy
Exposure of corpus spongiosum
Dissection of neovaginal canal
Incision of penile corpora and excision of spongiosum of penis
Construction and fixation of clitoris
Resection and reconstruction of urethra
Pre-placement of skin tube anchoring sutures and incision for inset of clitoro-urethral complex
Attachment of skin graft to penile skin flap and insertion of composite skin tube into neovaginal canal
Final wound closure

Vulvar construction

Construction of the vulva involves removing the testicles and unneeded penile and urethral tissue, constructing the clitoris and urethral meatus, and wound closure. Orchectomy is performed through the primary incision. **Figure 1** demonstrates pre- and post-operative anatomy. **Figure 2a** demonstrates the pattern of skin incisions that this author believes results in reliable results regardless of body habitus.³² An alternative approach to marking the Labia majora skin incisions is to mark the Labia majora incisions along the lateral edges of the scrotum (**Figure 2b**, green arrow), and not at the groin creases. Doing so may, for some patients, make the labia less wide and therefore more pendulous, and, places the incision line closer to the center of the Labia, where blending with the scrotal-skin rugae may make the incision line less visible.



Figure 1a: Pre-Operative Anatomy

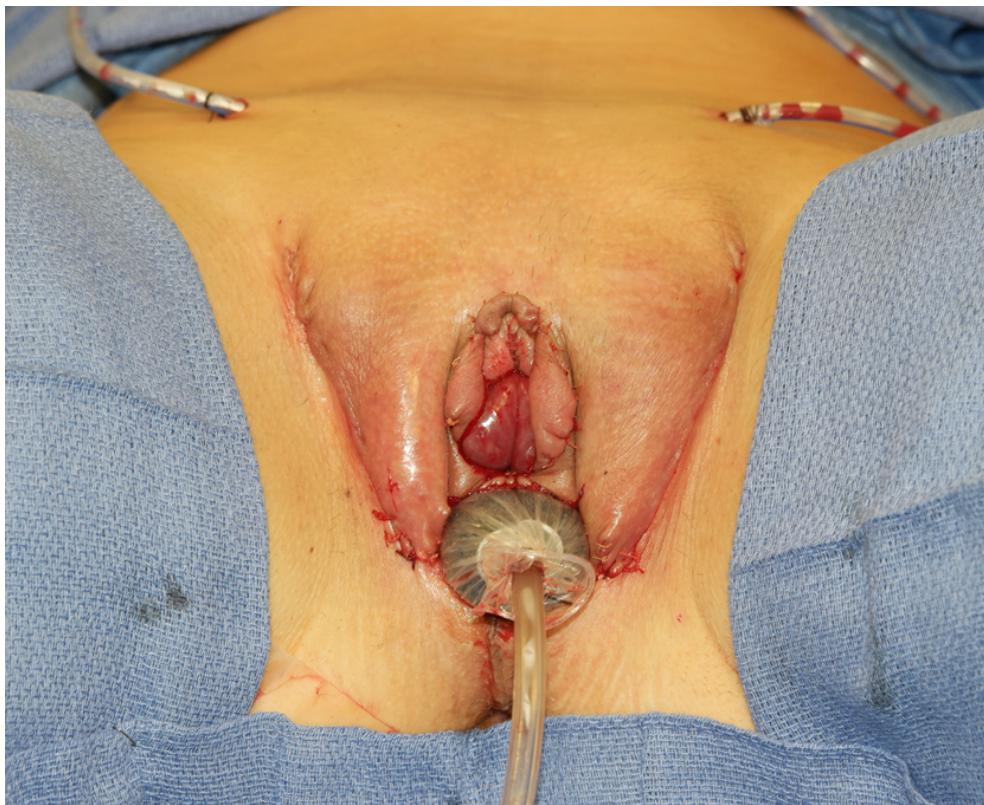


Figure 1b: Early Post-Operative Anatomy



Figure 1c: Post-Operative Anatomy at 6 months

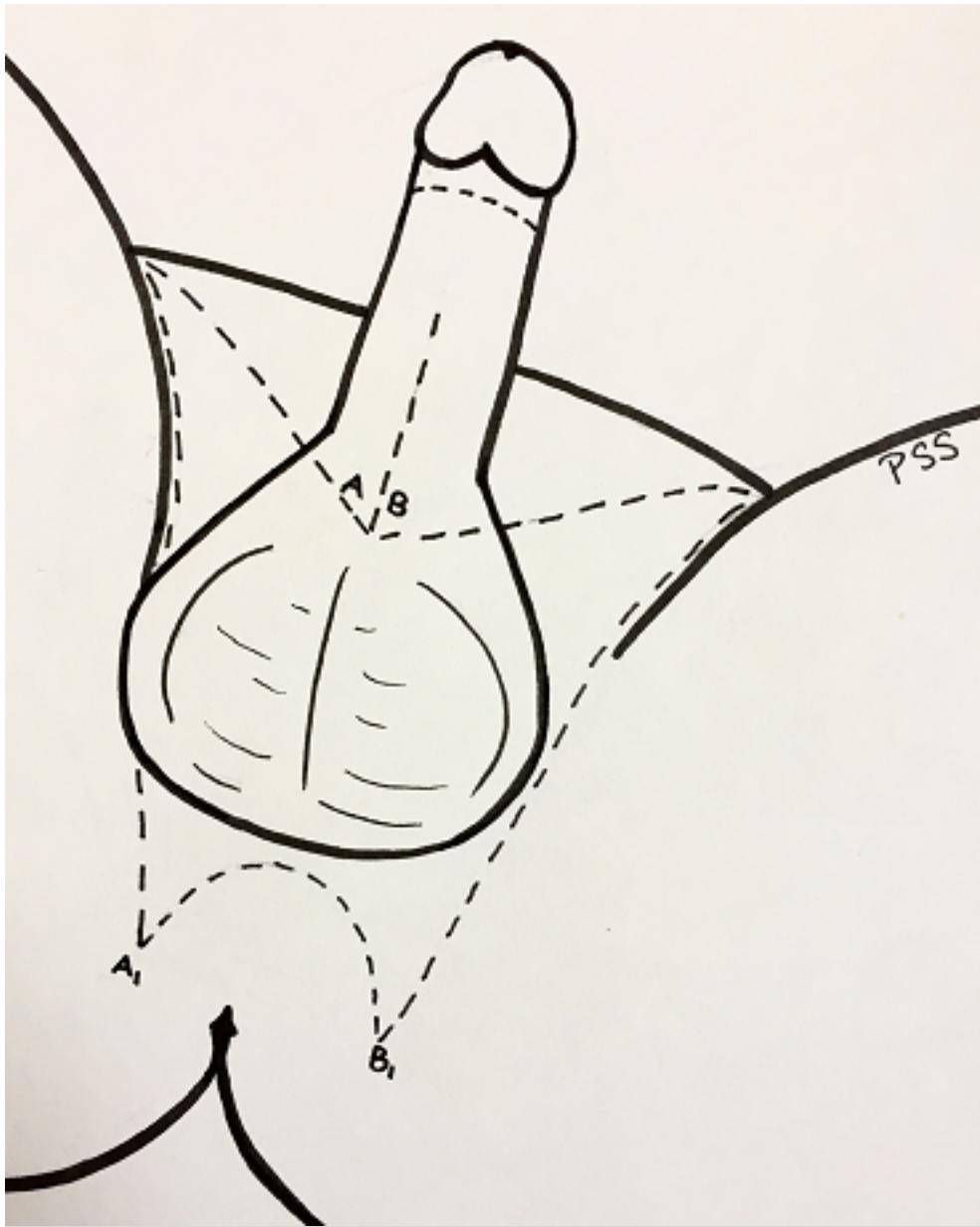


Figure 2a: Pattern of Skin Incision Utilized for Penile Inversion Vaginoplasty

Editorial Comment: Figure 2b

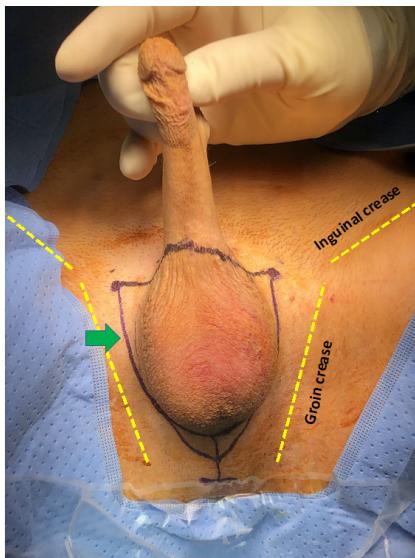


Figure 2b

Penile Skin Use and Preparation of Dorsal Neurovascular Bundle

One major goal of vaginoplasty is to remove the erectile capabilities of the penis and construct a sensate clitoris from the glans penis based on a pedicle of the dorsal neurovascular bundle. A circumcising incision allows degloving of the penis. The neurovascular bundle may be dissected from the underlying tunica albuginea, allowing the corpora to be excised. This approach is similar to elevation of the neurovascular bundle for Peyronie's plaque incision and grafting,³³ although it must be done the full length of the penis. Given the potential for injury to the neurovascular bundle, most surgeons now leave the neurovascular bundle intact on the tunica albuginea. After corporotomies, the spongiosum is removed³⁴ (**Figure 3**). In addition to a faster, less traumatic handling of the neurovascular bundle, the additional bulk of the folded tunica albuginea with this technique has an aesthetic benefit as it provides more volume in the area of the mons pubis,³⁴ which can otherwise have a hollow appearance after removal of the penile structures.

Construction of the Neoclitoris, Clitoral Hood, and Labia Minora

Techniques of constructing a neoclitoris have evolved greatly. Despite the central importance of the clitoris to female genital anatomy and sexual function, some prominent surgeons in decades past did not routinely construct a neoclitoris.³⁵ Although a technique similar to what we use currently was described in 1976,³⁶ a variety of techniques, including deliberately transecting the dorsal nerve and creating the clitoris from a graft, were used in the past.³⁷ Creation of a neoclitoris on a dorsal neurovascular bundle pedicle was debated and only came into wider use in the 1990s (**Figure 4**).³⁸

Many surgeons use a small portion of the glans to make the clitoris.³⁹ Recognizing that the nerve density of the glans penis may be only 1/3 or less than that of the glans clitoris,⁴⁰ we believe that more tissue is needed to keep adequate erogenous potential. We use the majority of the corona and excise the central portion of the glans, with the rationale that keeping the corona where nerves insert from the dorsal bundle is likely to permit the greatest erogenous sensation (**Figure 5**).

Figure 3

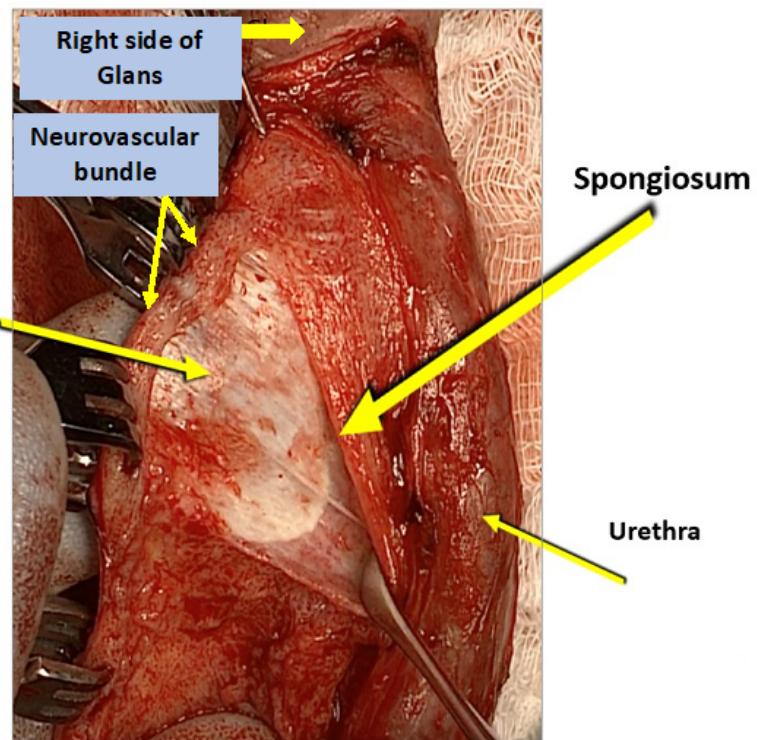


Figure 3: Preparation of the Dorsal Neurovascular Bundle with Removal of Erectile Tissue

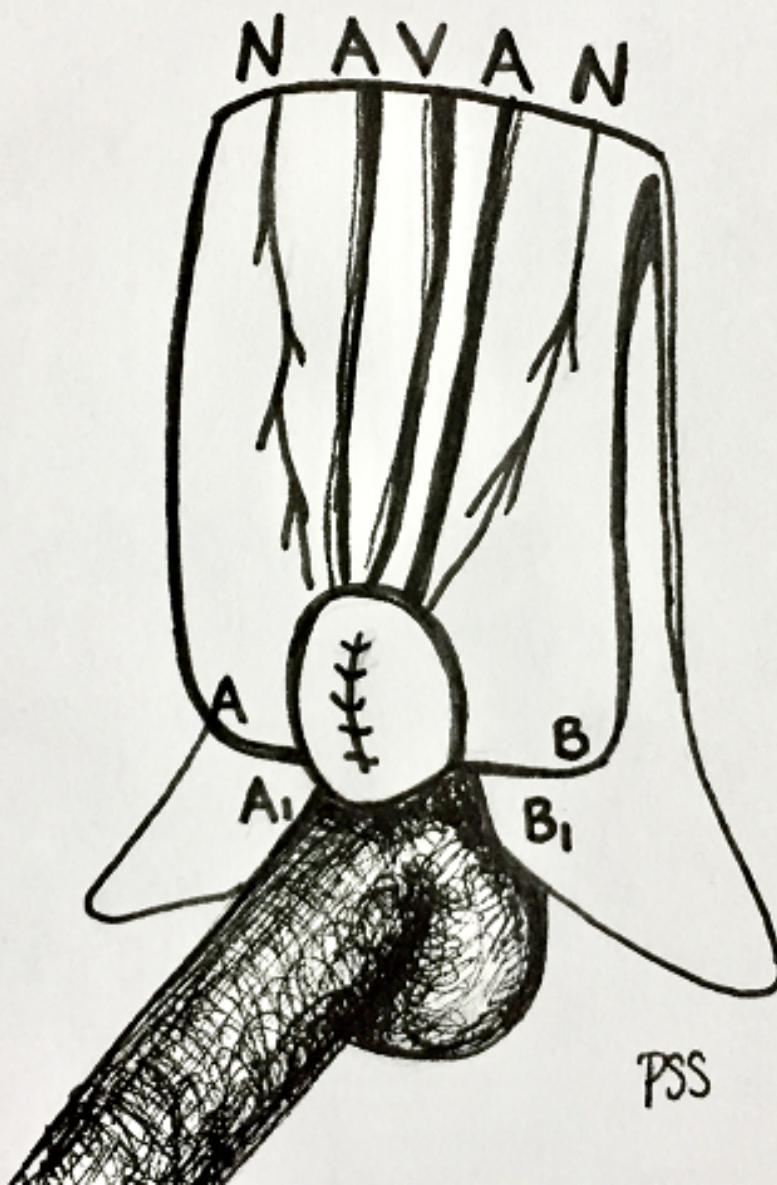


Figure 4: Schematic Representation of Neoclitoris Reconstruction
on a Dorsal Neurovascular Bundle Pedicle

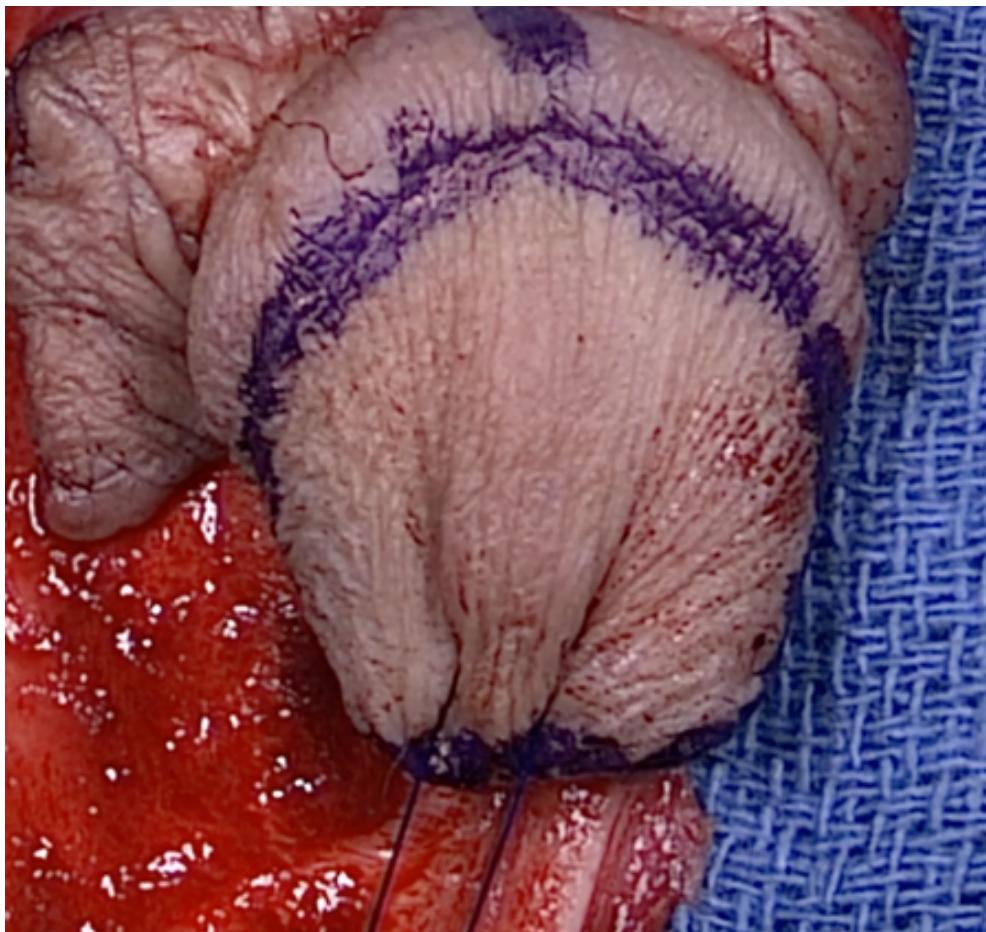


Figure 5a: Neoclitoris Reconstruction Marking Template

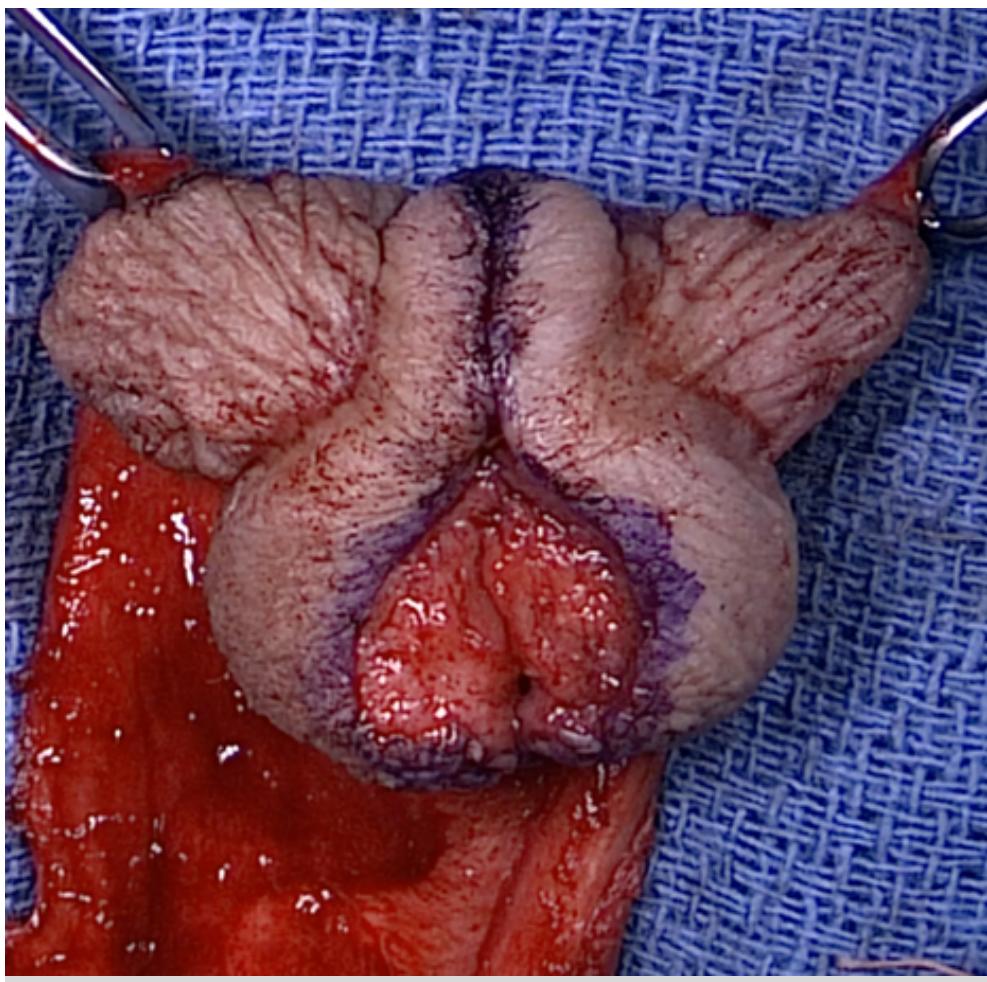


Figure 5b: Neoclitoris Reconstruction

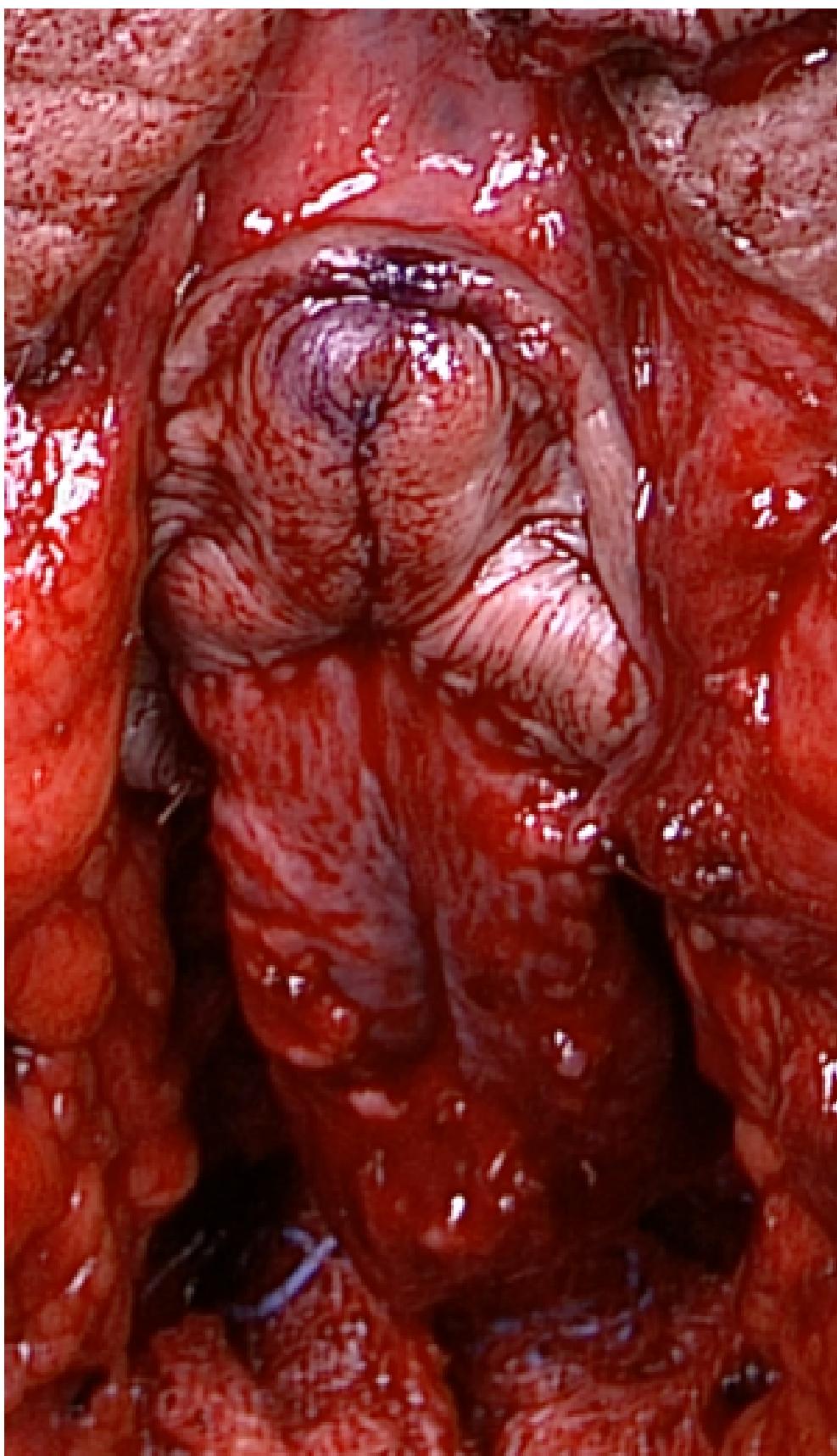


Figure 5c: Neoclitoris Reconstruction After Attachement of Urethral Plate

Editorial Comment: Figure 5D

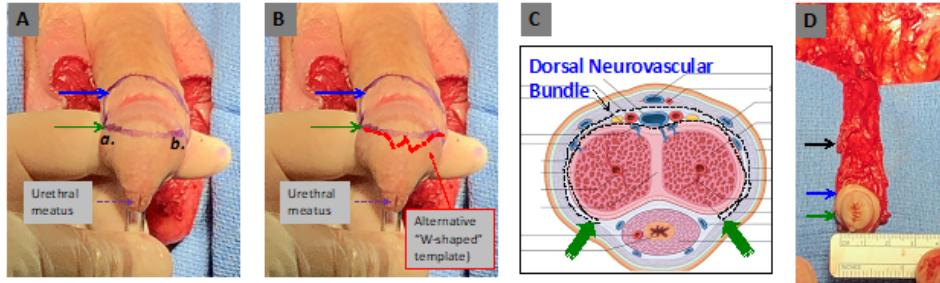


Figure 5d

Alternative templates for dissection of the glans to construct the neoclitoris include simply drawing a subtle “smile-shaped” curve across the anterior aspect of the glans, approximately 7-8 mm from the coronal ridge (**Figure 5D, A**). The corners of the glans-segment (Figure 5a, b) are then sutured together, and the neoclitoris edges are sutured together along the midline. Another alternative is to draw a similar but “W-shaped” template (Figure 5b). Which template is used is based on surgeon-preference, though less complex templates are more expeditious to construct during surgery. Many transfeminine patients prefer that the glans clitoris size not be especially prominent and similar in dimensions to a cisgender woman’s, which is 3.5-7 mm width and length.⁴¹ To best manage patient expectations, the anticipated general vulva dimensions, which include the glans clitoris, should be discussed preoperatively.

An alternative approach to harvest the dorsal neurovascular bundle (NVB) is to elevate it (within Buck’s fascia), off of the dorsal penile shaft tunica sharply. We use a 15-blade scalpel to gently incise Buck’s fascia (but not the tunica) longitudinally, along the entire length of the penis, just lateral to the junction of the urethra and the tunica of the corpora (**Figure 5D, C**; green arrows). Then, using black-handled tenotomy scissors, we dissect the remainder of the glans clitoris off of the tips of the corpora, and then dissect the NVB in a distal to proximal direction towards the base of the shaft, just proximal to where the penile corpora will be amputated. The result is a NVB packet that is often less thick and bulky than when it includes dorsal tunica (especially if all of the spongy tissue from the ventral surface of the tunica is not excised). However, it is possible that patients may prefer greater bulk cephalad to the glans clitoris. As with many of the aesthetic aspects of this reconstructive surgery, decision-making should include both surgeon judgement and patient preference.

Urethroplasty

Relatively little is published on urethral reconstruction in vaginoplasty. Many patients report bother by urinary issues after vaginoplasty,²¹ Including as high as 33% with a misdirected urine stream in some reports.⁴² Urethral stenosis is one of the most common complications, occurring in approximately 15% of cases.⁴³ Three factors guide our handling of the urethra: positioning of the neomeatus, resection of redundant spongiosum beneath the neomeatus, and how much of the corpus spongiosum and urethra distal to the meatus is retained.

The positioning of the urethral meatus is an important consideration. Many patients who have undergone vaginoplasty complain of their urine stream being directed too far forward and hitting the toilet seat while voiding. Making the urethral meatus as low as possible, in direct line with the exit from the urinary sphincter (**Figure 6a**), allows as straight a path as possible for the urine to exit. While this may mean that the distance between the urethral meatus and clitoris is greater than in the natal vulva, this is one of the compromises often necessary in gender-affirming vulvar construction in the android pelvis. Positioning of the meatus distal to this point results in an anteriorly directed urinary stream. Patients benefit from counselling of appropriate positioning and posterior tilting of the pelvis during voiding. Additionally, patients need to be counselled about the possibility of requiring revision surgery to reposition the urethral meatus in order to avoid an anteriorly displaced urinary stream.

Resection of the excess, bulky corpus spongiosum at the base of the bulb beneath the new meatus (**Figure 6b-6c**) *limits* engorgement during sexual arousal and narrows the vaginal introitus.^{42,44} Removing the wide base of the bulbospongiosum shortens the visual distance between the meatus and the vaginal canal and may create a more natural-appearing introitus. The urethral mucosa and corpus spongiosum may be used to line the space between the neomeatus and the neoclitoris^{36,45} or as a longer flap to create the clitoral hood.¹⁷

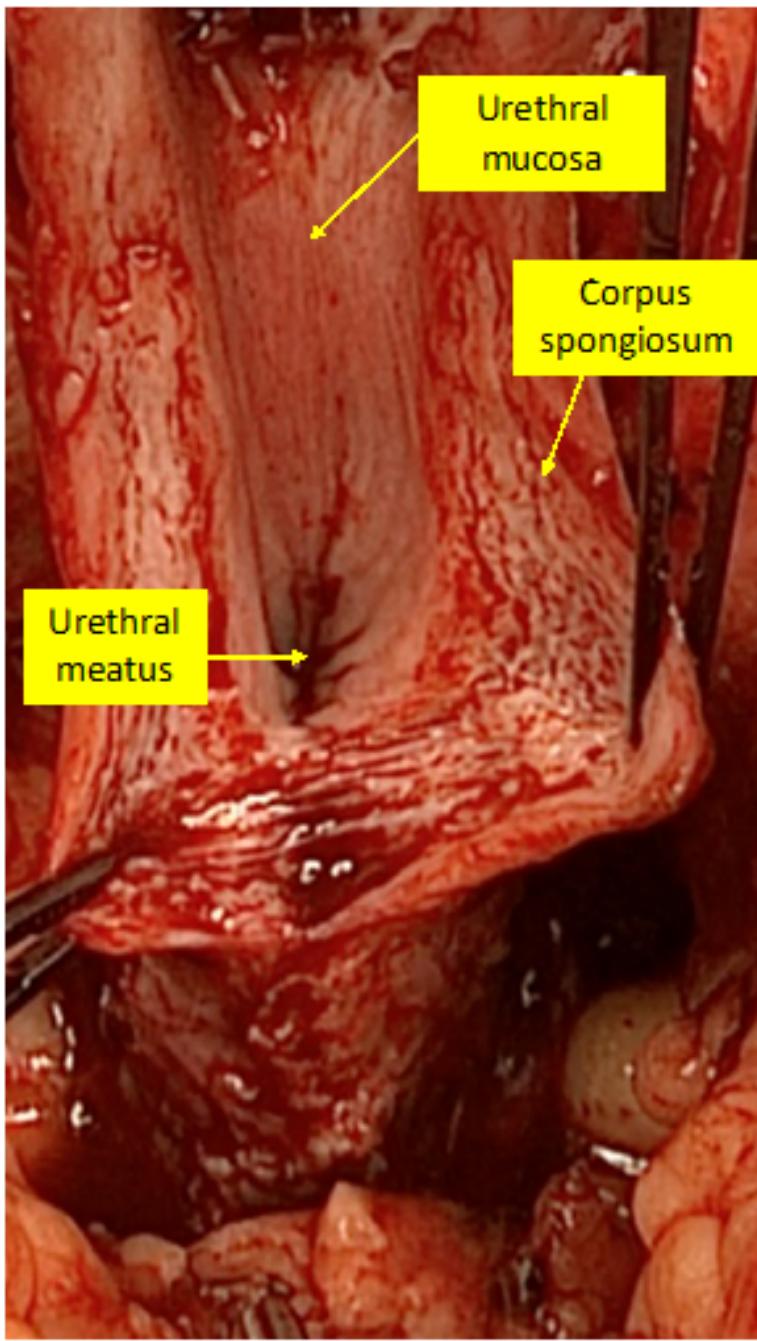


Figure 6a: Proximal Dissection of Urethra

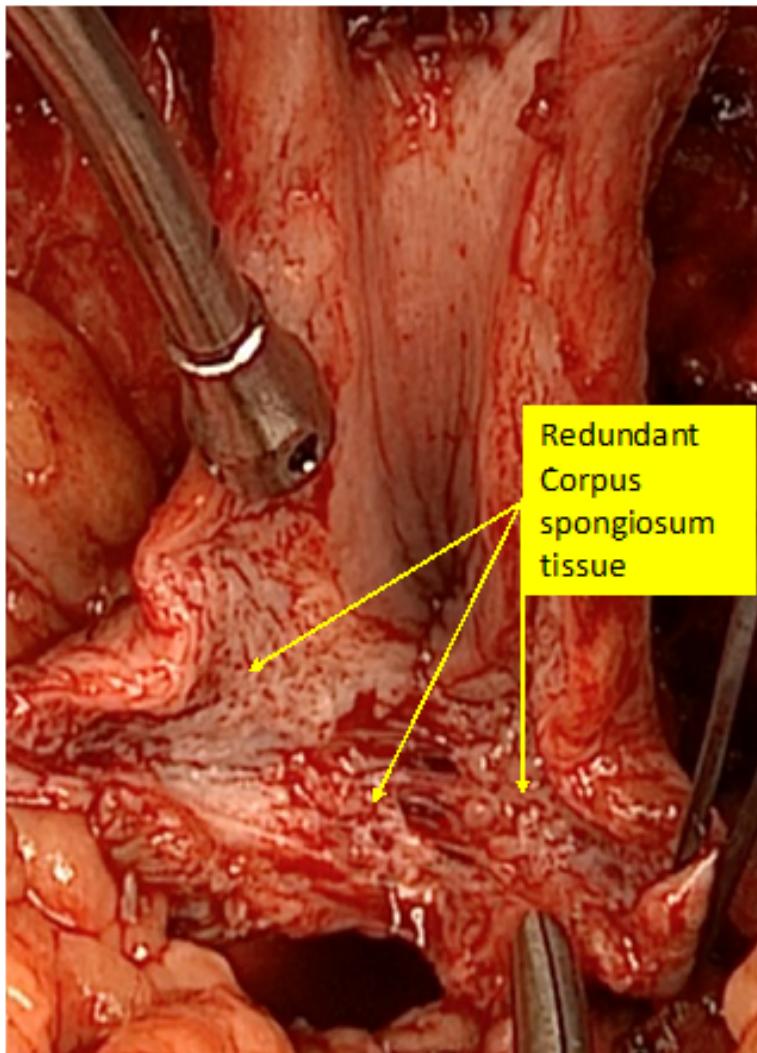


Figure 6b: Redundant Spongiosal Tissue Inferior to Urethral Meatus

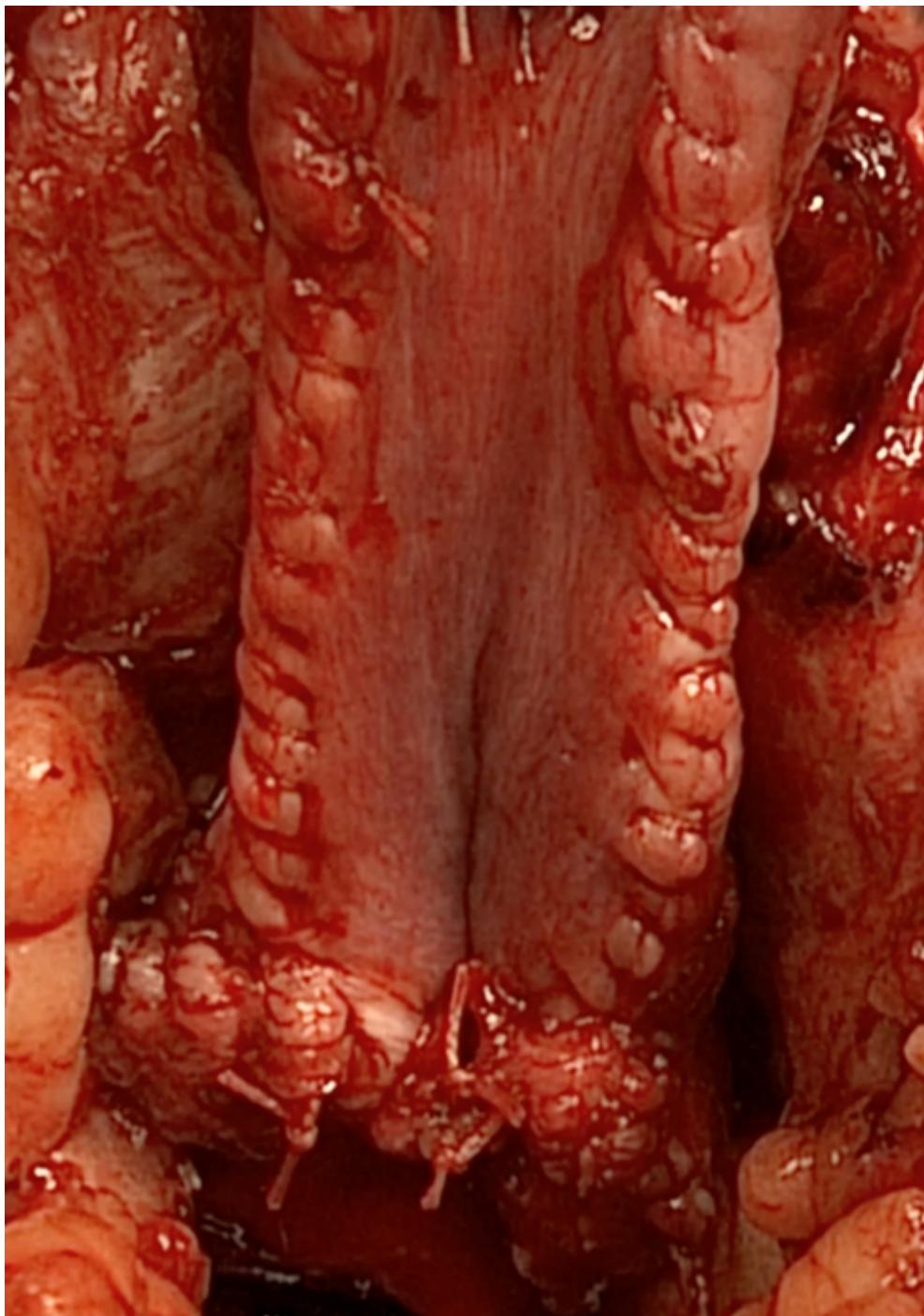


Figure 6c: Completed Resection of Redundant Bulbar Spongiosal Tissue

Vaginal Canal Construction

Vaginal Canal Dissection (Perineal Approach)

To create the neovaginal space, a plane must be developed between the lower urinary tract and rectum. The vaginal canal creation follows Hugh Hampton Young's approach to perineal prostatectomy.⁴⁶ Dissection proceeds cautiously with bipolar scissors through the perineal body and onto the body of the prostate. A Lowsley prostatic retractor is helpful to identify the course of the urethra and the location of the body of the prostate (**Figure 7a**). The anorectal junction is closely

associated with the apex of the prostate and is at risk of injury.⁴⁷ Frequent digital rectal examination and palpation of the Lowsley retractor to identify the apex of the prostate and the area of the urinary sphincter are extremely helpful to guide safe dissection.

The neovaginal canal space must be created anterior to Denonvillier's Fascia (DVF). In order to enter this surgical plane anterior to DVF, it is necessary to transect the insertion of DVF upon the posterior aspect of the prostate apex. This dissection leads to the prostate capsule, where Denonvillier's Fascia terminates upon the posterior aspect of the prostate capsule apex, approximately 1.5-2 cm from the apex (when the latter is rotated anteriorly).⁴⁸

As an alternative to using a Lowsley retractor, a Van Buren male urethral sound can also be used to dissect the vaginal canal space (**Figure 7b, A**). Both instruments rotate the apex of the prostate anteriorly.

A key goal of the technique described is to transect DVF as safely as possible, to avoid a rectal injury. This is accomplished by transecting the insertion of DVF directly upon the prostate itself (specifically, the posterior aspect of the prostate apex).

To do so, we begin dissection through superficial tissues onto the prostate capsule, to a horizontal line 1 cm from the posterior face of the prostate apex. (To find this location, we palpate for the metal urethral sound, and then target prostate capsule 1-1.5 cm inferiorly (i.e. towards prostate mid-gland, on the prostate's posterior aspect). [Note: We do not dissect more posteriorly than 1-1.5 cm from the prostate apex due to increased risk of a rectal injury; when the prostate apex is rotated anteriorly, the posteriorly-located rectum is also pulled anteriorly, and can be injured. If the horizontal dissection is carried out too far anteriorly (i.e. close to the prostate apex), one risks a urethral injury, at the dissection. Hence, to avoid a rectal injury it is best to limit the horizontal dissection to a location 1-1.5 cm from the posterior aspect of the prostate apex].

Before inserting the sound into the urethra to push the prostate inferiorly (from behind the Pubic symphysis to the perineal wound, where it can be palpated), only non-distinct soft tissue is palpable at the junction of the Urethral bulb and the rectum (**Figure 7b, B**). However, when the Van Buren sound's short, curved portion is placed at the bladder neck (as shown with the Lowelsly retractor in **Figure 7**), and downward pressure is applied while the sound's handle is pushed cephalad, the following occurs: 1. The location of the prostate is shifted inferiorly, where it can be palpated at midline below the arch of the pubic symphysis; 2. The apex of the prostate is rotated anteriorly (**Figure 7b, C**); and 3. The posterior aspect of the apex is exposed in the surgical field and can be palpated by The surgeon (**Figure 7b, D**). The anterior extension of the perineal body is the central tendon along the Bulb of the urethra, and the posterior extension of the perineal body is contiguous with DVF, which is the avascular fascial plane that separates the rectum from the prostate and bladder (**Figure 7b, C**).

Figure 7c: As the horizontal dissection 1-1.5 cm from the apex of the posterior aspect of the prostate is continued and tissues overlying this location are dropped inferiorly, the prostate capsule comes into view (**Figure 7c; #1-4**). It is helpful to secure a Babcock clamp to the corpus spongiosus muscle

of the bulb, and apply upward traction to the clamp in order to better expose the prostate. Once the prostate capsule is exposed, the flat end of a Simon retractor (handle pointing towards the floor) is oriented parallel to the bed and the flat end is gently pressed against the prostate capsule. The tip of the retractor lies 1-1.5 cm from the posterior aspect of the prostate apex, where the insertion of the DVF onto the prostate was already transected. Simultaneously, the male urethral sound is withdrawn from the urethra. As this occurs, the blade of the Simon retractor will advance anterior to DVF in a cephalad direction along the avascular tissue plane immediately anterior to DVF. Once the first Simon retractor blade has been inserted, a second Simon retractor blade (handle pointing towards the ceiling) is slid alongside the first retractor blade (**Figure 7c, 5**). The retractor handles are lifted in opposite directions (**Figure 7c, 6**), to spread the canal space anteriorly and posteriorly to facilitate further dissection of the canal space using an empty sponge stick clamp.

Once the plane between the ventral rectal fascia (sometimes referred to as posterior Denonvillier's fascia) and prostate is developed, a mold or a dilator may be used to bluntly dissect up to the peritoneal reflection (**Figure 8**).

As an alternative, a sponge stick clamp can be used to gently dissect cephalad, along the avascular plane anterior to DVF, towards the recto-vesical peritoneal reflection (also referred to as the Pouch of Douglas). To do so, the flat tongs of the empty sponge stick clamp are positioned horizontally in the deepest part of the canal space. Here, the yellow-appearing adipose tissue anterior to DVF adherent to the rectum is distinct. Gentle pressure is applied in a cephalad direction, as the tongs of the clamp are gently spread apart to carry the horizontal dissection in a cephalad direction. Care is taken to not dissect through the recto-vesical reflection of peritoneum, as doing so would allow bowel to enter the vaginal canal space.

Figure 7a

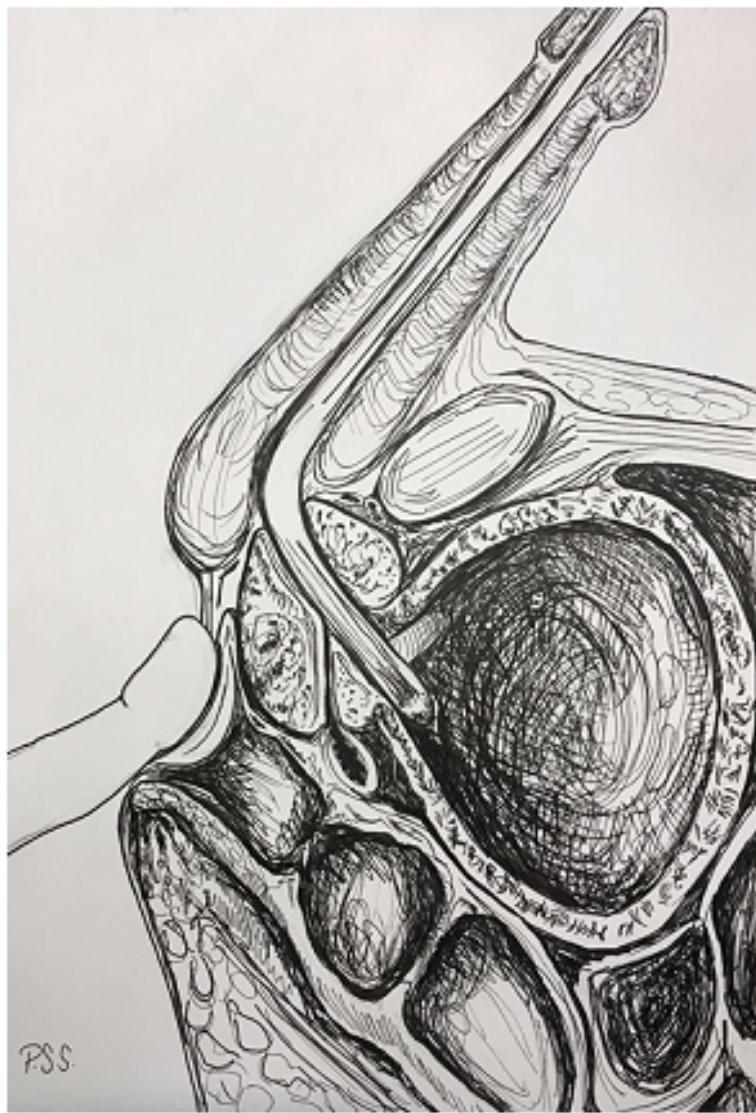


Figure 7a: Schematic Representation of Vaginal Canal Dissection with Lowsley Retractor

Alternative: Dissection of the Vaginal Canal Space Using a Male Urethral Sound

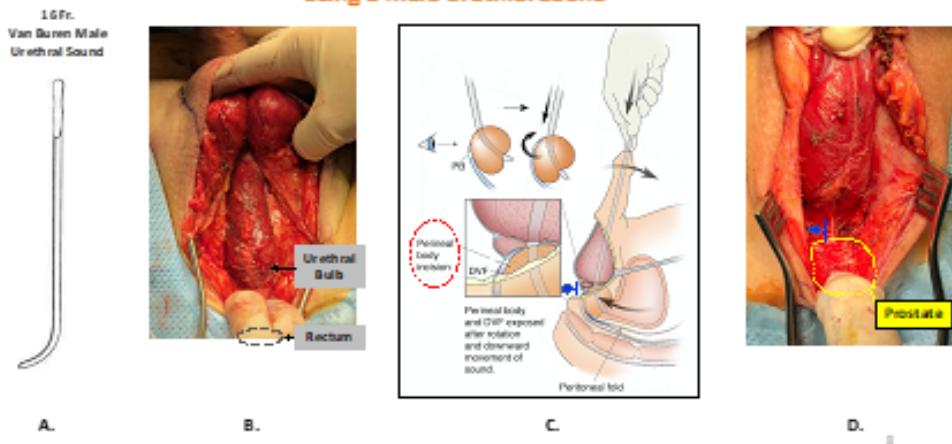


Figure 7b

Editorial Comment: Figure 7c

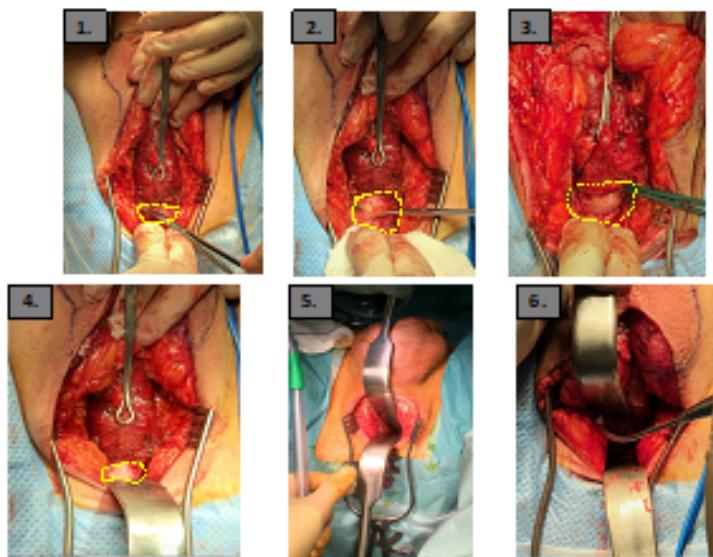


Figure 7c



Figure 8: Vaginal Mold

After dissection of the neovaginal canal space, the levator muscles (puborectalis and puboanalis) are partially divided at 3:00 and 9:00 clockface positions to widen the vaginal canal.

Lining the Neovaginal Space

The traditional description of “penile inversion vaginoplasty” uses the penile skin alone as a flap to line the vaginal canal. The penile skin flap has several advantages: it is sensate, thin, largely hairless, well-vascularized, and elastic. The greatest limitation is its limited availability due to the

range of penile lengths and/or prior circumcision. A full-thickness scrotal skin graft can provide additional canal coverage beyond what penile skin can provide (**Figure 9**).⁴⁹

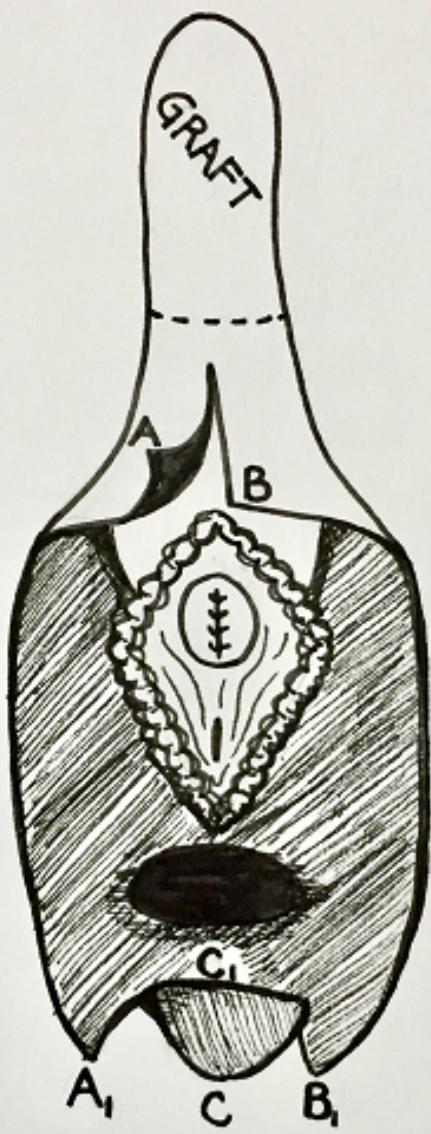
Occasionally, there is not enough genital skin to fully cover the canal as either graft or flap. In those cases, an additional full-thickness skin graft⁵⁰ may be required. The authors prefer harvesting from the area near the iliac crest, bilaterally if necessary because it is often a hairless area.

Skin grafts require meticulous preparation of the graft and graft bed⁵¹ with particular attention to hemostasis to avoid hematoma formation, which can cause graft failure. The neovaginal canal is meticulously inspected for hemostasis. This is extremely important as anywhere that a blood clot forms between the graft and the surrounding tissue will lead to graft or flap failure in that location.

Immobilization of the graft to prevent shearing from the graft bed is also important. The Belgrade team has described suture fixation of the vaginal canal to the sacrospinous ligament.⁵² The authors use fibrin glue to adhere the graft and skin flap to the underlying tissue, as well as to minimize tension on the skin tube. Other centers do not place fixation sutures or surgical glues, and rely on use of a vaginal pack with or without closed-suction wound drains, and limited mobilization to optimize flap/graf take with good outcomes. Approaches vary by surgeon and center. Typically, a vaginal pack³⁵ is used to maintain gentle pressure on the skin graft to optimize take (**Figure 10a**).

Alternative approaches for maintaining the neovaginal canal packed and distended to optimize graft take to surrounding pelvic tissues is to pack the canal with a vaginal packing thinly coated in Silvadene. (**Figure 10b; Right**) To maintain the packing in place and prevent it from being pushed out of the canal by normal Valsalva pressure, after packing the canal the vaginal introitus is covered with gauze and 3-inch wide pieces of foam tape. (**Figure 10b; Left**) The surgical drains and Foley urinary catheter tubes are placed at midline and the drain receptacles are placed over the chest. Each piece of foam tape is first anchored onto each buttock (while the patient's pelvis is lifted upward by two assistants, before extubation), and then it is pulled anteriorly and, in front of the vulva, it is crossed over to the contralateral side and affixed, on gentle tension, to the paramedian abdominal wall just below the nipple. A total of 4 foam strips (2 per side) are sufficient to maintain the packing in place. We recommend always placing 1-2 wound drains within the canal space, to drain blood and edema fluid collection, as fluid collection between the graft and the pelvic tissues to which it must adhere will prevent graft take and result in graft loss.

Our practice is to first pack the vaginal canal space, and then afterwards, insert a gloved finger along, but external to, the vaginal canal graft, at 3:00 and 9:00 around the canal. We then use a sponge stick clamp to deliver the shortened end of a 15 Fr. round perforated closed-suction wound drain at the 3:00 and 9:00 locations. These are externalized via a stab-incision in perineum skin immediately lateral to the vaginal canal (see X's: Figure 10b, Left panel) Provided that drain outputs are less than 5 cc per day, these are removed in the morning of post-operative day #6, after the patient has been out of bed to chair for the first time, typically in the evening of post-operative day #5.



PSS

Figure 9: Schematic Representation of Vulvar Reconstruction

Figure 10a



Figure 10a: Vaginal Packing Sponge within External Condom

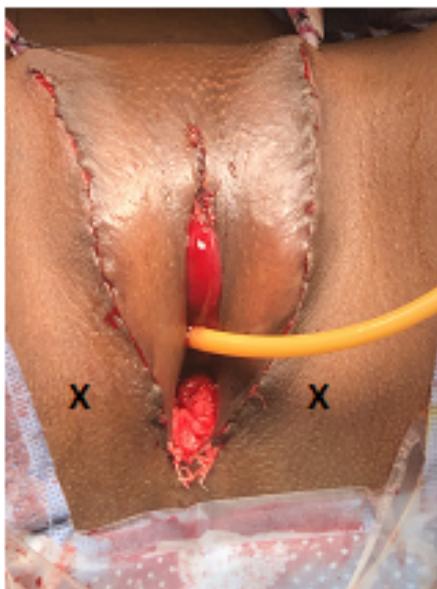


Figure 10b : (Left) Vaginal packing in place at completion of vaginoplasty.
(Right) Vaginal Packing is kept in place by covering the wound with Xeroform
and gauze dressings, and overlying these with four individual pieces of 3-
inch wide foam tape. Each piece is anchored to a buttock, and then crossed
over to the contralateral abdominal wall.

Figure 10b

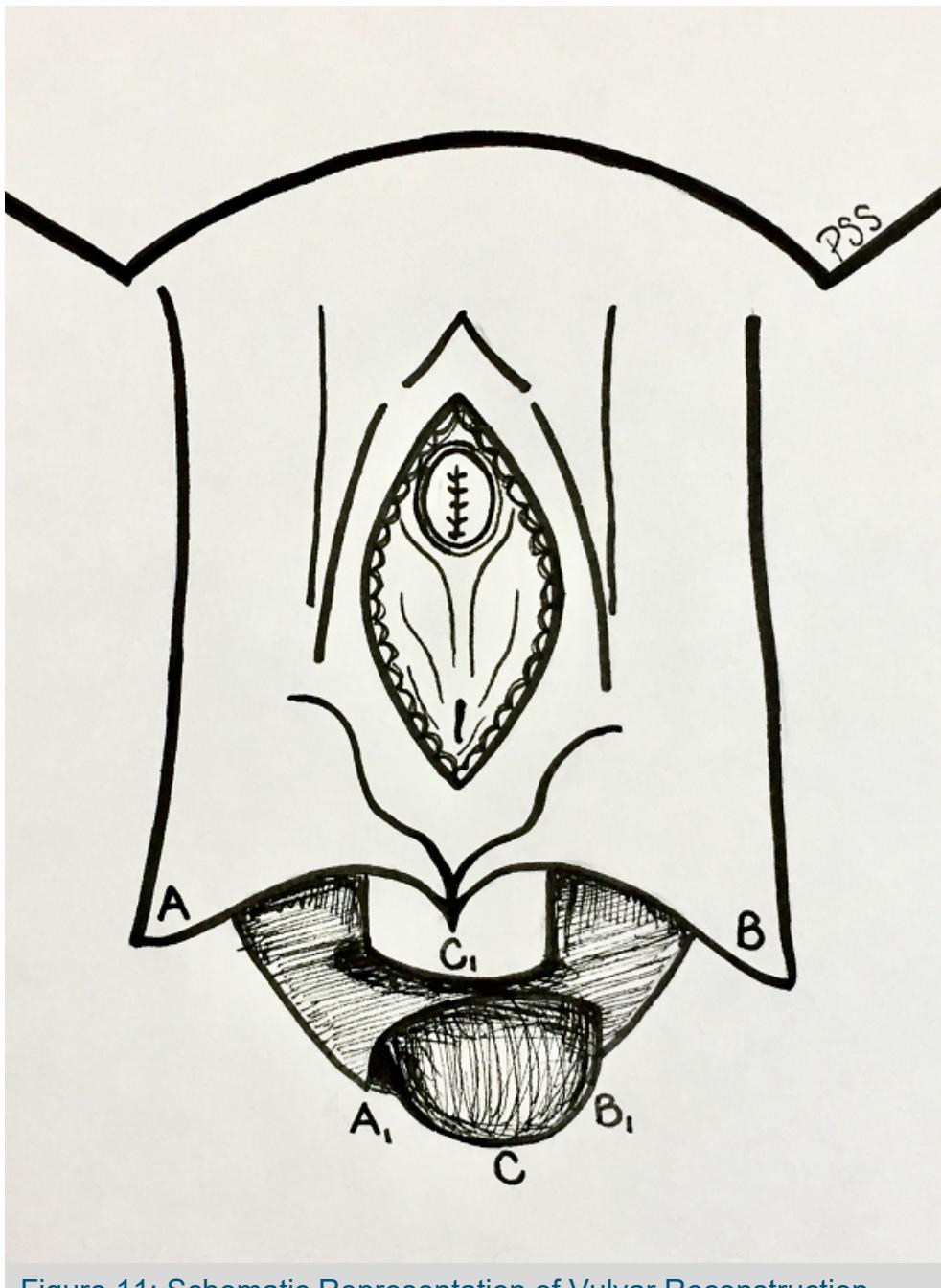


Figure 11: Schematic Representation of Vulvar Reconstruction

Wound Closure

Following insertion of the penile and scrotal skin tube into the vaginal canal space (**Figure 11**), the labia minora and majora are completed with excision of redundant tissue and approximation of external penile and scrotal flap edges. Post-operative labial and urethral flap edema are expected and surgeons are advised to leave more underlying fat in anticipation of labial flattening after the initial edema resides, in addition to longer-term atrophy.⁵³

Dressings and Hospital Stay

Though post-operative dressings and regimens vary by surgeon and center, these often include:

- Vaginal packing, typically for 5 days

- Foley catheterization while vaginal packing is in place
- Bedrest, typically for 1-5 days
- Venous thromboembolism prophylaxis
- An outer compressive dressing

Approximately 15% of patients will experience urinary retention and need temporary catheter replacement.⁵⁴ Most patients leave the hospital on post-operative day 5. Many institutions have been able to shorten hospital stays with implementation of ERAS protocols and extensive education of patients and caregivers.

4.2 Robotic peritoneal flap vaginoplasty

Robotic-assisted gender affirming vaginoplasty techniques utilizing peritoneum to line, and thereby augment net vaginal canal depth, have been described for use during both primary vaginoplasty and secondary (salvage) surgeries following post-operative loss of depth. These techniques augment depth with peritoneum at the vaginal canal apex. One, first described by Zhao et al, utilizes combined anterior and posterior local flaps of peritoneum, harvested from the posterior bladder wall and the anterior and adjacent surfaces of the rectum. The other technique, termed *Tubularized Urachus-Peritoneal Hinge-Flap Vaginoplasty*, was first described by Garcia et al and uses a long flap of peritoneum harvested exclusively from the bladder dome and anterior abdominal wall.

Anterior Bladder and Posterior Pararectal Peritoneal Flaps

Zhao and colleagues have described their technique of a robotic approach for vaginal canal dissection and construction with the use of local peritoneal flaps harvested from the posterior bladder wall anteriorly, and from the anterior and adjacent surface of the rectum posteriorly. . This is an adaptation used in both primary and revision vaginoplasty, and can be performed using both Da Vinci Xi and SP robotic systems (Intuitive, Sunnyvale, CA).^{55,56} Penile inversion techniques are used for creation of the vulva, with or without use of scrotal skin as a graft to create the deepest portion of the vaginal canal. Peritoneal flaps may potentially decrease the need to augment the inverted penile skin flap & scrotal skin graft with extra-genital skin grafts (e.g. full-thickness suprapubic or thigh skin) when penile & scrotal skin are in limited supply.⁵⁵ (**Figure 12**).

In patients who have undergone prior vaginoplasty complicated by neovaginal stenosis, reconstruction is challenging due to paucity of tissue and difficult surgical exposure, with high risk of injury to the urinary tract, bowel and rectum. A robotic peritoneal flap technique has a potential advantage of facilitating antegrade dissection through the plane between the bladder and rectum with transabdominal visualization of these structures. Also, it allows for minimally invasive harvest of peritoneal flaps to restore satisfactory canal depth, while minimizing or avoiding skin grafts or bowel harvest. In cases of complete canal obliteration, additional skin grafts may be needed to cover the portion of the neovagina between the introitus and peritoneal flaps.

Surgical Technique

If using a multi-port system (Da Vinci Xi), robotic ports may be placed inferiorly using the HiDES

technique for improved cosmesis (**Figure 13a**).⁵⁶ When using Single Port system, two small abdominal incisions are required to accommodate the SP trocar and an assistant port. (**Figure 13b**) A semi-circular incision is made above the umbilicus and a 2.7 cm vertical incision made through the fascia. The peritoneum is incised sharply before placement of the SP trocar and blunt obturator under direct vision. The cap of the trocar is removed to visually confirm appropriate intra-abdominal position prior to placement of the inner cannula. The patient is placed in steep Trendelenberg position (typically 30-40 degrees, or until the bowel is adequately cleared from the pelvis). The patient's abdomen is insufflated to 15 mmHg for placement of a 5 mm assistant port under direct vision, approximately 2 fingerbreadths above the anterior superior iliac spine. Insufflation is then decreased to 10–12 mmHg. The robot is side-docked to allow for concurrent perineal access, where the perineal surgeon performs the vulvar construction.

The procedure typically begins with lysis of sigmoidal adhesions on the left pelvic sidewall for full exposure of the rectovesical space. A horizontal incision is made in the peritoneum overlying the seminal vesicles in the rectovesical pouch. This horizontal incision is widened laterally beneath the vas deferens on each side. Dissection is carried out beneath the seminal vesicles. Denovilliers fascia is incised to develop a space between the prostate and rectum for the neovaginal canal. During this dissection, the full thickness skin graft, previously harvested from resected scrotal skin, is wrapped around a 38 mm (diameter) dilator and sewn into a tubular structure for attachment to the penile skin tube. The neovaginal space is widened, requiring incision of Levator ani and pelvic side wall musculature until the cavity easily accommodates the dilator. Concurrently, the perineal dissection is typically carried out from beneath the bulbar urethra, through the perineal body, to the level of the perineal membrane. The robotic dissection is then continued towards the perineum until the transabdominal and perineal dissection spaces are joined.

The anterior peritoneal flap is raised from the posterior aspect of the bladder, approximately 8-12 cm wide by 8-12 cm long (**Figure 14a**), with the vas deferens and the medial umbilical ligaments serving as the lateral borders. Filling of the bladder can help identify the superior border of the anterior flap. The posterior peritoneal flaps are raised adjacent to the rectum, with the ureters as the lateral borders, and the sacral promontory as the superior border of the posterior flaps.

The penoscrotal skin is inverted and passed into the vaginal cavity. The posterior peritoneal flap is sutured to the inferior aspect of the penoscrotal skin, and the anterior peritoneal flap is sutured to the superior aspect using a barbed 3-0 absorbable suture to create a circumferential anastomosis. At the apex of the newly extended neovagina, the posterior peritoneal flaps are sutured to one another across the rectum, then sutured to the apex of the anterior flap. The anterior and posterior flaps are approximated in a running fashion using a 3-0 absorbable barbed or spiral suture to exclude the vagina from the abdominal cavity. The pre-vesical space may be developed to decrease tension on the anterior flap and apical closure. Vaginal packing of Kerlex roll gauze soaked with mupirocin, bacitracin and lubricant is placed prior to complete closure of the vaginal apex to ensure extension beyond the peritoneal anastomosis, into the apex of the neovagina (**Figure 14b**). The abdomen is irrigated and all instruments removed under direct visualization.

Upon completion of the surgery, the fascia is closed. Vaginal packing of lubricant and antibiotic-soaked Kerlex gauze is used to compress the skin graft portion of the canal, and an external vacuum-assisted dressing is applied over the introitus to draw fluid from the wound.

Post-operative care is similar to that described above for traditional penile inversion vaginoplasty, with the exception of immediate post-operative dilation after vaginal packing removal on post-operative day #5.

Alternative laparoscopic peritoneal techniques have been described including the peritoneal pull through approach, in which larger peritoneal flaps are harvested and then anastomosed to the penile skin flap. It does not require the use of scrotal skin. This technique benefits those with genital skin hypoplasia.⁵⁷

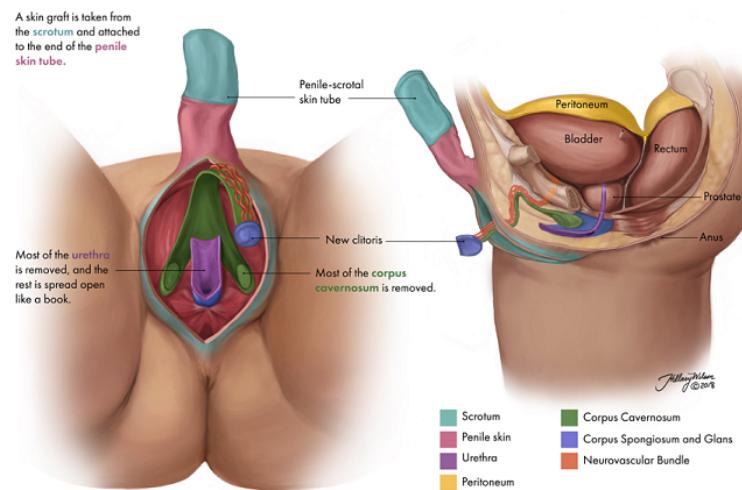


Figure 12a: Construction of Inversion Flap with Robotic Peritoneal Flap Vaginoplasty

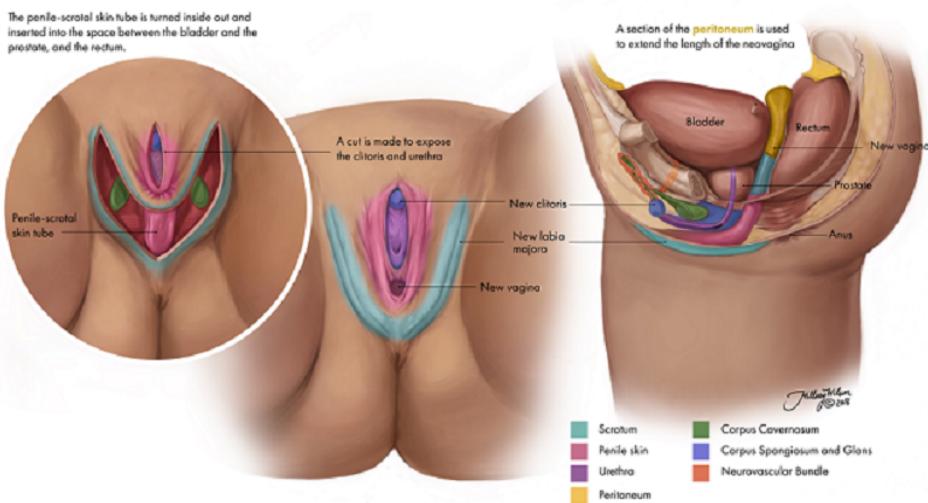


Figure 12b: Reconstruction of Vulva and Vaginal Canal with Robotic Peritoneal Flap Vaginoplasty

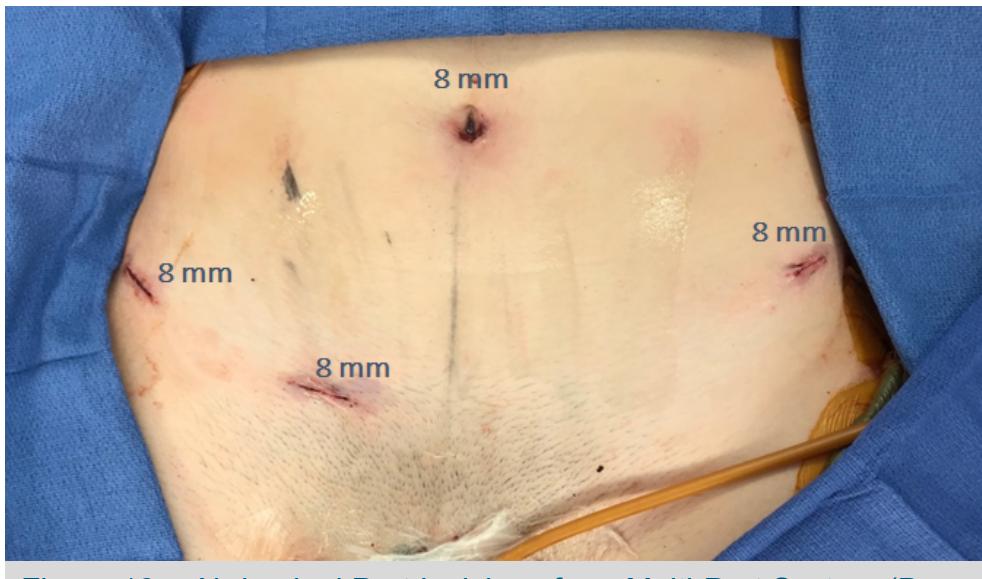


Figure 13a: Abdominal Port Incisions for a Multi-Port System (Da Vinci Xi) During Robotic Peritoneal Flap Vaginoplasty

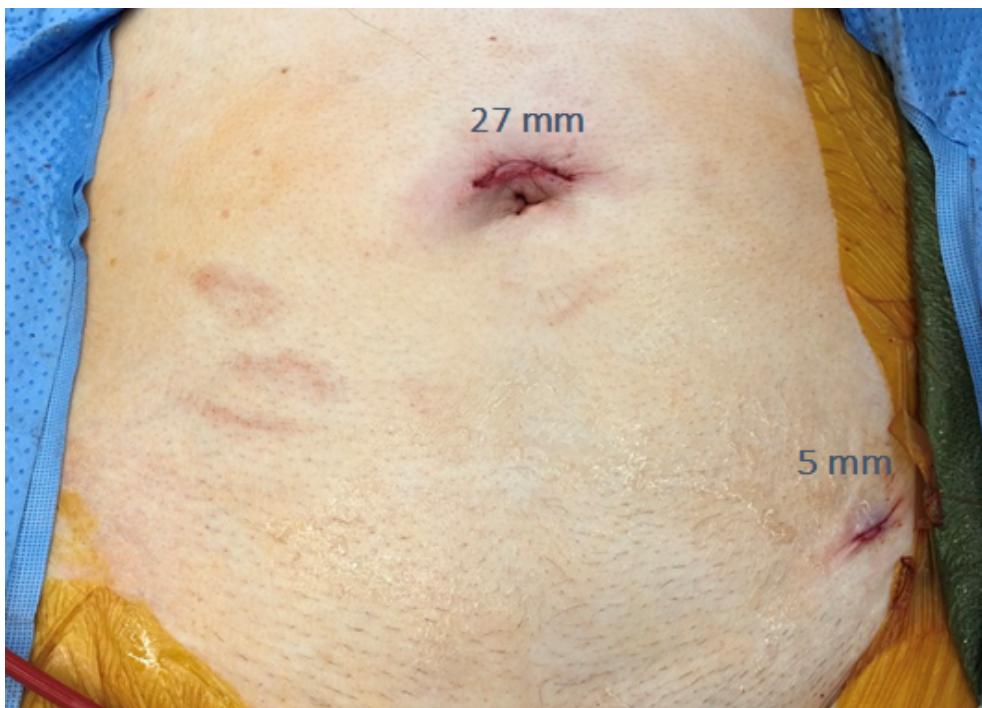


Figure 13b: Abdominal Port Incisions for a Single-Port System During Robotic Peritoneal Flap Vaginoplasty

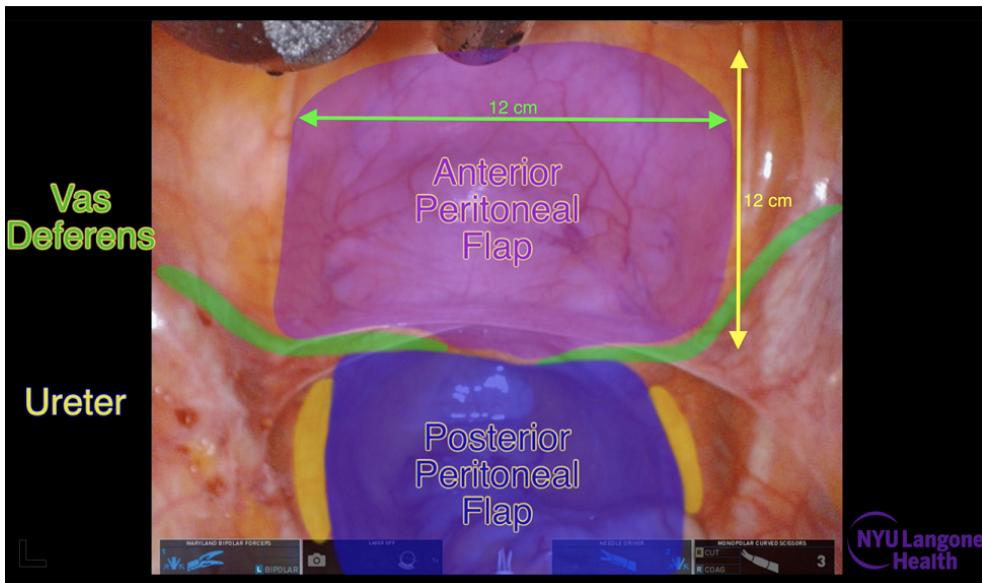


Figure 14a: Peritoneal Flap (Anterior and Posterior) Donor Segments During Robotic Peritoneal Flap Vaginoplasty

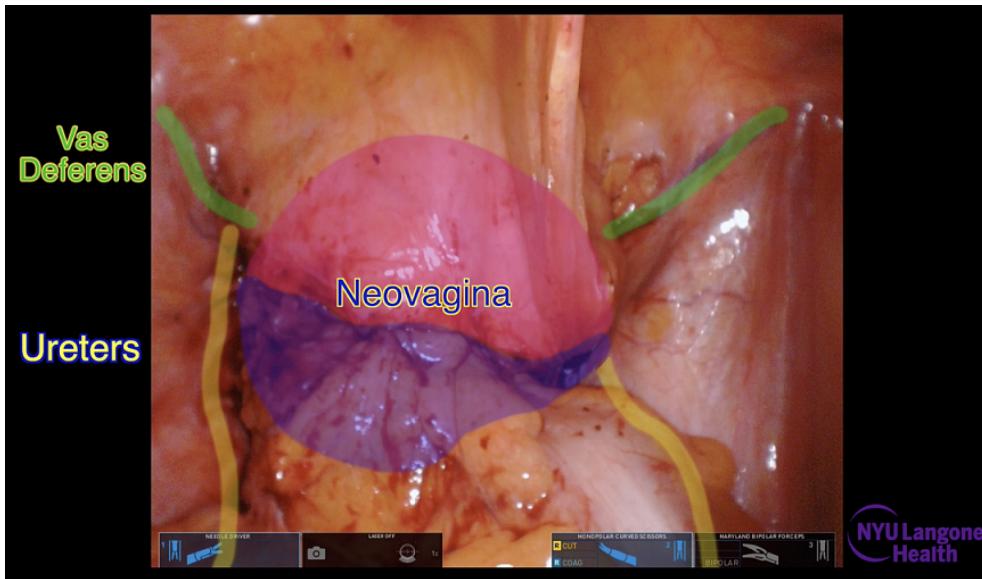


Figure 14b: Neovagina Completion During Peritoneal Flap Vaginoplasty

Editorial Comment: Figure 14c

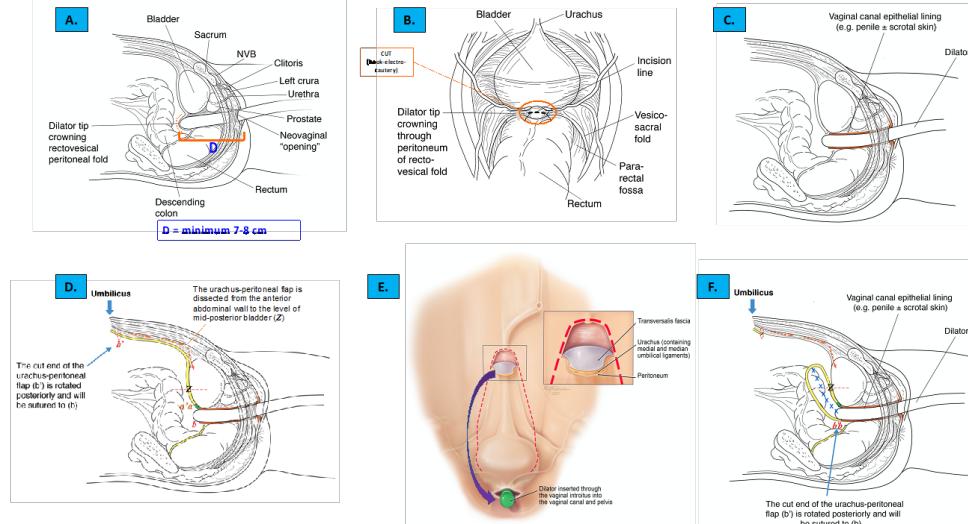


Figure 14c

Tubularized Urachus-Peritoneal Hinge-Flap

An alternative robot-assisted laparoscopic peritoneal flap vaginoplasty technique is the Tubularized Urachus-Peritoneal Hinge-Flap vaginoplasty described as a salvage technique to treat inadequate vaginal depth or post-operative loss of vaginal depth (e.g. from failure of graft take at the vaginal vault).^{58,59}

The authors that utilize this technique find that this requires that the residual vaginal canal depth must be a minimum of 7-8 cm. (see **Figure 14c, A**). This is because if the residual canal is shorter than 7-8 cm, it will be especially challenging to suture the cut edges of residual canal epithelium to surrounding peritoneum anteriorly, and to the peritoneal flap end posteriorly. With a vaginal dilator within the residual canal, the canal vault is incised with hook cautery via a laparoscopic approach from within the pelvis. (**Figure 14c, B**) The dilator-tip is then visualized within the pelvis and is used to identify the canal epithelium edges. (**Figure 14c, C**) The anterior edge of epithelium from the residual vaginal canal is sutured to the cut-edge of peritoneum located just anterior to where the vaginal canal vault was incised at the recto-vesical fold. (**Figure 14c, D**; green) Next, an ~8 cm wide flap of urachus and overlying peritoneum/transversalis fascia is elevated from the anterior abdominal wall and off of the dome of the bladder. (**Figure 14c, E**) The cephalad (peri-umbilical) end of the peritoneal flap is then rotated backward and sutured to the posterior edge of the vaginal canal epithelium (**Figure 14c, D-F**), using V-lock absorbable monofilament sutures. Lastly, the anterior & posterior lateral-edges of the now folded peritoneal flap are sutured together on either side (**Figure 14c, F**; X's).

In previous work re-dissecting the vaginal canal space after failed penile inversion vaginoplasty , the authors have found that the mean resting distance between the vaginal introitus and the recto-vesical peritoneal fold is 10.8 cm (SD 0.91).²³ The reason that the proposed minimum required vaginal depth is 3-4 cm less than this value is because the surrounding peritoneum of the anterior recto-vesical fold can be stretched caudally to reach the vaginal canal epithelium, but (in the authors' experience) only

as much as ~3-4 cm. Also, when the residual vaginal canal depth is less than 7-8 cm, the cut edges of the canal to which the peritoneum must be sutured are located deep between the bladder and rectum, where it is technically challenging to visualize the tissue edges and to suture.

There are several proposed advantages to this technique relative to alternative techniques utilizing peritoneum: 1. The new neovaginal vault has no suture line; 2. The hinge flap's suture lines are not subject to stretch and tension at rest; 3. The rectum is completely excluded from the neovagina; 4. The urachus-based peritoneal flap is composed of three layers (peritoneum, urachus, and transversalis fascia), instead of only peritoneum. Each layer has, ostensibly, an independent blood supply.

Early outcomes with this technique have been reassuring, but modest. The mean *net increase* in vaginal depth immediately post-op was +8.2 cm, but by 1 year this was found to have decreased to +4.9 cm.[ch2] [ma3] [ch4] Nonetheless, high patient satisfaction with this even modest net long-term increase in depth was reported.

A challenge with comparing studies using peritoneum is that combined use of scrotal skin makes it difficult to assess the contribution of peritoneum versus skin to short and long-term vaginal depth. As with all relatively new surgical techniques, =not only early but long-term outcomes (always compared to similarly measured pre-op measurements), should be studied.

While the tubularized urachus-peritoneal hinge flap technique could be used in primary vaginoplasty, the authors believe that it is best to reserve use of peritoneum for salvage surgeries, as at the time of primary surgery non-penile skin grafts (e.g. scrotal skin) would still be required anyway. Furthermore, specific graft-templates and graft tubularization techniques designed to maximize final length and surface area can often yield sufficient scrotal skin to achieve satisfactory vaginal depth. ³

An advantage of using peritoneum in a delayed fashion is that it allows opportunity to confirm that the penile and scrotal skin portions lining the canal will survive, and that it will yield adequate canal width.

4.3 Intestinal vaginoplasty

Intestinal vaginoplasty is a well-described technique for gender affirmation and management of vaginal agenesis.^{56-60,61,62,63,64} Isolation of the bowel segment can be performed using an open or minimally invasive laparoscopic approach. Pedicled intestinal transfer requires identification of a 12 to 18 cm intestinal segment, typically sigmoid or ileum, which is then isolated and transferred on its vascular pedicle through a canal space dissected between the bladder and rectum. The distal end of the enteric segment is then sutured to skin flaps created from the perineum. To reduce the risk of prolapse, the surgeon may affix the lateral portions of the neovagina to the levator ani muscles,⁶⁰ or suture the serosa of the bowel to the abdominal wall⁶⁰ or sacral promontory.²³ The bowel provides natural mucus lubrication, and its mucosa may better approximate that of a natal vagina. Enteric vaginoplasty may also provide greater vaginal depth. However, dilation is still required to avoid narrowing of the anastomosis at the introitus, or narrowing from extrinsic scar tissue where the intestinal segment passes through the peritoneal reflection at the recto-vesical junction, with resulting

mucus accumulation in the deepest portion of the intestinal segment.²³ It is recommended that patients with intestinal segments douche regularly and undergo vaginoscopy whenever mucus accumulation within the proximal segment is suspected. Studies on intestinal vaginoplasty as a primary and revision vaginoplasty approach have shown good overall functional and aesthetic results.⁶²⁻⁶³⁻⁶⁴

Garcia *et al.* describe a new surgical technique and initial outcomes using right ascending colon for salvage and primary vaginoplasty with gGAS, and they weigh the relative advantages of this technique over the intestinal segments most commonly represented in the literature (Sigmoid colon and ileum).²⁴ Briefly, the right ascending colon and proximal - most transverse colon are mobilized and transected, leaving only the ileocolic artery as blood supply. The distal segment end is delivered to the vaginal introitus through an opening in the recto-vesical peritoneal fold that follows the vaginal canal space.

The principal advantage of use of the right colon is that its vascular pedicle, the ileocolic artery, is typically longer, and has less variable anatomy, than sigmoid colon and ileum, making it ideal for use with salvage vaginoplasty, where the distal end of the intestinal segment must reach the vaginal introitus (**Figure 15**). This is especially important, as they found that the distance between the neovaginal introitus and the recto-vesical peritoneal fold among transgender women in their series was significant (10.8 cm [SD 0.9]), and precluded the use of peritoneal flaps alone. (**Figure 16**). The authors found that in the setting of salvage vaginoplasty where the vaginal canal tissue bed is already scarred and often irregular, use of a single right colon segment with a robust dedicated blood supply was preferable to use of a combination of peritoneal flaps and skin grafts to span the distance from the vaginal introitus to past the recto-vesical fold.

While the authors acknowledge that right colon vaginoplasty can be used for primary surgery, given the more invasive nature of intestinal segment harvest, and the common availability of penile, scrotal and peritoneal tissue sources for primary vaginoplasty, their preference is to reserve use of intestinal vaginoplasty for salvage surgery cases. This is typically completed when there is either a residual vaginal canal depth that is <6-7 cm, or, the entire residual vaginal canal remnant is too narrow for satisfactory vaginal receptive intercourse.

To decrease risk of introitus stenosis, the distal segment is anastomosed (interrupted 2-0 Vicryl sutures) to a 12-cm circumference opening in the skin at the center of the vaginal introitus. It is then secured to the sacral promontory (or anterior abdominal wall) to prevent full-thickness prolapse. To optimize cosmesis, immediately before pexy to the sacral promontory, the colon segment is gently pulled into the pelvis, in order to recess the colon mucosa into the introitus. Patients remain in hospital typically through post-op day #5 when the majority resume bowel function. Prior to discharge, they are taught to douche daily and dilate for 8 minutes twice per day, to a depth not to exceed 7 inches (distance to pexy suture).

The authors report early success to reduce the incidence of diversion colitis by using an anti-inflammatory agent plus short-chain fatty acid enemas once per month. Mucus production

typically slows significantly ~3 months after surgery,¹⁶ though mild discharge continues indefinitely. Contrary to some expectations, colon neovaginas have no specific odor, especially as compared to vaginal canals made from skin, in which bacterial odor can result in foul odor. Overall patient satisfaction with cosmesis and function is reported to be encouragingly good.^{17,61}

Figure 15

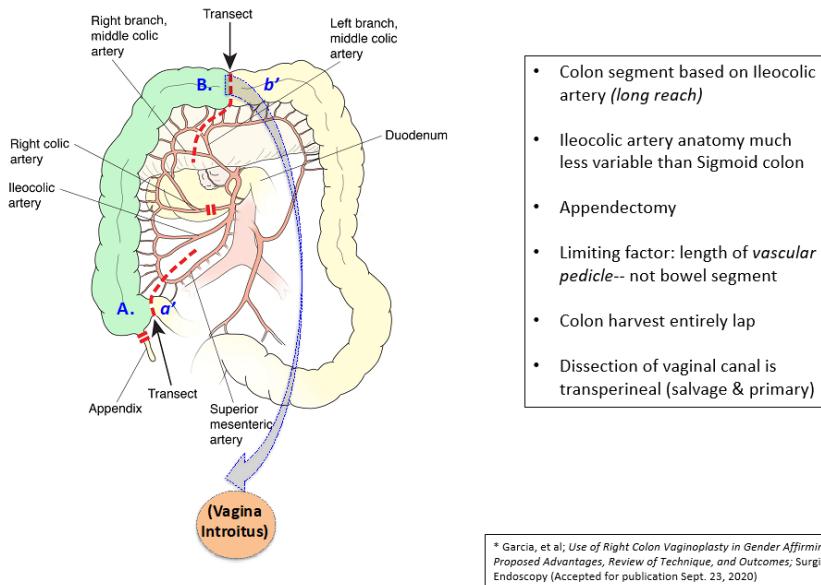


Figure 15: Right Hemicolon Vaginoplasty Donor Site

Figure 16

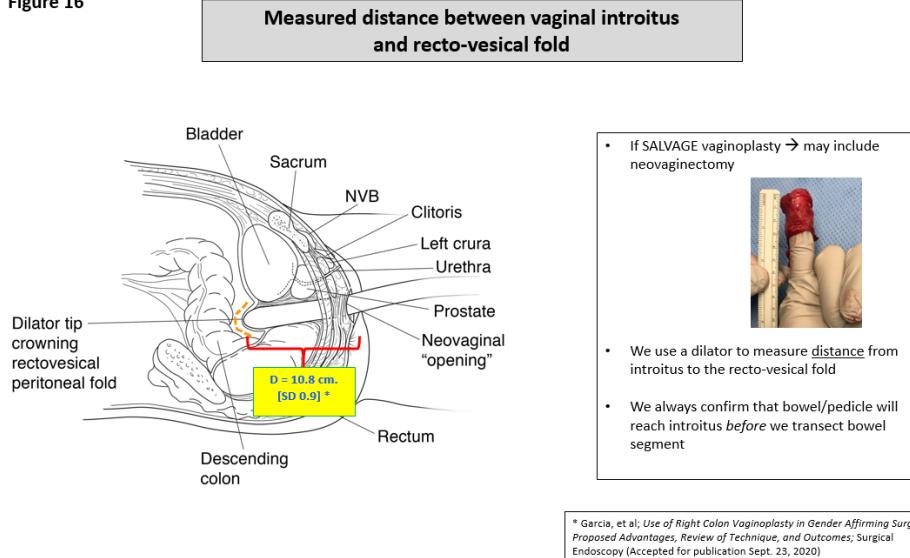


Figure 16: Sagittal Pelvis Demonstrating Recto-Vesical Fold to Vaginal Introitus Distance

5. Post-Operative Care

Dilation of the Neovagina

The process of wound healing and secondary contraction of skin grafts can lead to stenosis of the neovaginal space in some patients. Many surgeons instruct patients to perform dilation of the

neovaginal canal to prevent narrowing or stenosis; despite these efforts, vaginal stenosis has been reported in approximately 10% of patients.⁴³

As the neovagina passes through a new opening through the pelvic floor muscles, patients must learn to relax their pelvic floor in order to successfully perform dilation or have receptive vaginal intercourse. Patients are instructed on how to perform dilation of the neovagina and are given a set of dilators. Many surgeons begin dilation immediately, after vaginal pack removal or in the first 2 weeks after surgery, based on research showing secondary contraction of full thickness skin grafts reaches its maximum after one month.⁴³ Patients are instructed on how to perform dilation, and then observed on their own. They are generally asked to dilate for 30 minutes, 3 times per day. While dilation regimens vary significantly by surgeon, the key to the successful maintenance of a vaginal canal is consistency and strict compliance to the regimen. Post-operative care may include routine visits, with pelvic floor physical therapy, to ensure optimal dilation technique.³¹

While it would be convenient to provide a written schedule in how to progress to larger dilators, we have observed great variability in how patients progress. We instruct patients to progress to the next largest dilator when their current dilator is no longer providing a “stretching” feeling.³¹ Progression is characterized by overlaps in dilator size—they may begin the session with a smaller dilator to help relax their pelvic floor and lubricate the neovagina before moving up to the larger dilator. If the larger dilator cannot be inserted to the maximal depth of the previously used dilator, patients are encouraged to continue to use the smaller dilator for a portion of the session to assure that the depth is maintained while still working on gaining width.

Many patients will find it difficult to maintain dilation 3 times per day as they return to work, school, etc. and frequently change to twice per day for several months. Once patients reach their goal size dilator and it is no longer difficult, they may begin to see if they can decrease the frequency of dilation. We encourage this gradually, with the ultimate goal of dilation only 1-2 times per week or less to make sure they are maintaining depth and width. Anecdotally, patients have reported loss of vaginal width and depth if they stop dilating or having vaginal sexual activity, even many years after surgery.

6. Vaginoplasty Without Creation of a Vaginal Canal

Gender-affirming vulvoplasty (also referred to as zero-depth or shallow depth vaginoplasty)²⁴ includes creation of the clitoris, Labia minora and Labia majora, and female urethral position without creation of an internal vaginal canal.²⁵

For individuals who do not desire to use a vaginal canal for sexual activity, have complex medical or surgical histories that would preclude safe canal creation, and/or do not want to undergo the pre- and post-operative care required for vaginal canal creation, vulvoplasty may be the most appropriate choice. In particular, creation of the vaginal canal requires pre-operative genital hair removal, intraoperative dissection of a neovaginal canal space with associated risks of injury to the rectum or lower urinary tract structures, bleeding and graft loss, among other longer-term canal complications,

as well as lifelong vaginal dilation and douching for vaginal hygiene.^{24,25}

7. Complications

Overall complication rates of vaginoplasty have been reported in meta-analysis as high as 32.5%.⁴³ Most are minor wound complications, however, including superficial skin necrosis and minor wound separation,⁶⁵ especially in the area of the posterior introitus where wound tension tends to be highest. Most wounds will respond to simple frequent dressing changes with dry fluffed gauze, and later silver nitrate treatment of granulation tissue if needed (**Figure 17**).

In a systematic review, including 13 studies on PIV, intraoperative complications such as “surgical bleeding” occurred in 3.2-10%.⁴³ Post-operative canal-related complications including introital stenosis occurred in 12% of 674 patients (range 4.2-15%), stenosis at another site in 7% (1-12%), and “vaginal shrinkage” in 2-10%. A review including more recent literature describes an introital stenosis rate of up to 15%. Partial necrosis of the neovagina ranged from 2.7-4.2%.²⁴ Rectal injury is a rare but potentially devastating event that can lead to rectovaginal fistula. In the systematic review by Horbach *et al.*, among four studies including 917 patients, 9 developed rectovaginal fistulae (mean 1%).⁶⁶

Complications associated with vulvar construction may include rare clitoral loss, loss of clitoral hooding, and cosmetic dissatisfaction.⁶⁷ We instruct patients to expect tissue swelling to gradually resolve by 8-12 weeks after surgery. We do not offer aesthetic revisions until 6-12 months after surgery, as the appearance continues to mature and usually improve during this time. Forward urinary stream or wide-spraying stream is the most common urinary complication, and is typically associated with obstructing skin or meatal stenosis (5.6-33%); this can typically be treated with simple meatoplasty or skin rearrangement.^{66,68} As noted above, approximately 15% of patients will experience acute urinary retention after catheter removal, which is typically self-limited.⁵⁴ Transient and persistent stress urinary incontinence, as well as other lower urinary tract symptoms, have not been widely studied.^{69,70} Urinary tract infection and sexually transmitted infection rates are also poorly described.^{71,72,73}

Potential complications of the newer robotic peritoneal flap approach include intraabdominal complications, such as small bowel obstruction, peritoneal flap dehiscence and herniation, pelvic abscess, and rectal injury, which are rare in the few published series.^{74,75,76} Additional theoretical risks of robotic canal dissection and peritoneal flap vaginoplasty include peritonitis, intraabdominal adhesions, and risks associated with intraabdominal and deep pelvis surgery including injury to the vasculature, rectum, ureters, bladder and urethra. Risks of robotic pelvic surgery include positioning-related neuropathies, port-site hernias, and equipment malfunction. The risks unique to intestinal vaginoplasty over PIV are those associated with intra-abdominal surgery and bowel harvest, including diversion neovaginitis and colitis,⁷⁷ peritonitis, intestinal obstruction, anastomotic leaks and fistulae, injury to adjacent organs and vasculature—as well as introital stenosis, mucocele, constipation, and potentially increased susceptibility to sexually transmitted infections.^{62,63,64,78} Early outcomes with right colon vaginoplasty have been described.¹⁷ The most common complications

associated with this technique were extrinsic stenosis at the introitus (9%), extrinsic stenosis where the segment passes through the peritoneal fold at the recto-vesical junction (9%), prolapse of the entire segment (reduced from 18% to 0% with pexy to the sacral promontory, prolapse of colon mucosa only (5%), and diversion colitis (14%). Despite retrograde dissection to re-establish a vaginal canal after near- total stenosis, injury to the rectum, bladder and collateral large vessels was not reported during the transperineal dissection into the pelvis. This is attributed principally to the use of a male urethral sound to guide incision through Denonvillier's fascia upon the surface of the prostate.

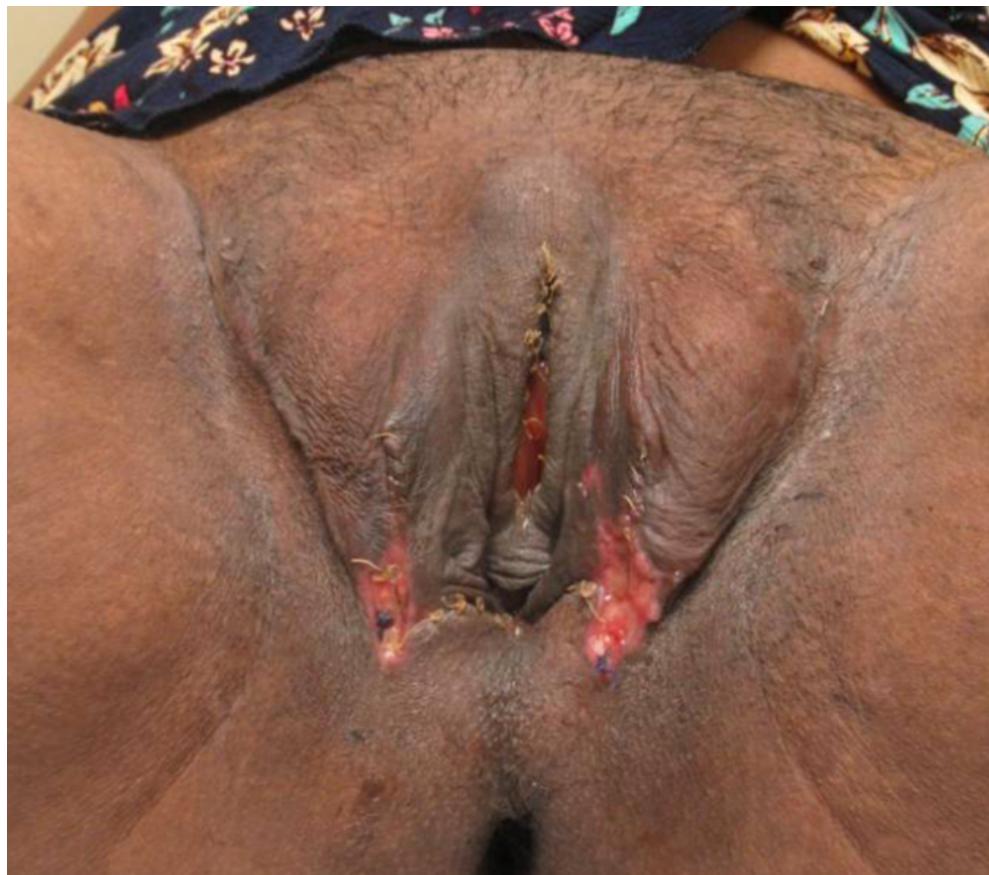


Figure 17a: Superficial Wound Separation During Early Healing
After Penile Inversion Vaginoplasty



Figure 17b: Superficial Wound Separation Demonstrating Healthy Healing 2 months Following Penile Inversion Vaginoplasty



Figure 17c: Superficial Wound Separation Completely Healed 6 months after Penile Inversion Vaginoplasty

8. Sexual function

Sexual function and satisfaction are key post-operative outcomes following vaginoplasty and vulvoplasty.²³ We encourage patients to use a vibrator for self-stimulation of the clitoris, the area above the clitoris (where the neurovascular bundle is folded), or the vaginal canal as soon as they please (once they begin dilation). We recommend they wait to manually stimulate the clitoris until enough time has passed to regain adequate tissue strength, which typically occurs after ~8-12 weeks. For those who undergo vaginal canal creation, we routinely recommend waiting 3 months after surgery to begin receptive vaginal sexual activity and encourage the patient to be mindful of how their dilation is progressing to predict how comfortable/safe receptive vaginal sexual activity may be.

Patients do not have natural vaginal lubrication that is created by transudation of fluid into the vaginal lumen following pelvic vascular engorgement.²⁹ We counsel patients that they will need exogenous lubrication for sexual activity afterwards. Anecdotally, some patients have reported self-lubrication; we presume that this may be fluid produced by the bulbourethral glands.

In the reported literature there has been high rates of patient-reported orgasm, up to 85% in contemporary series.⁷⁹ Erogenous sensation comes from a combination of clitoral stimulation, the distal vaginal canal skin and introitus, and stimulation of the prostate.⁷⁹ Lawrence⁸⁰ provided a

nuanced discussion of sexuality, both before and after surgery. While 82% of patients reported that orgasm was possible after surgery, only 48% were able to reach orgasm on at least half of their attempts. Interestingly, more than 50% reported that orgasms were substantially different than prior to their surgery. Hess *et al.* reported the majority of patients felt their orgasms were more intense after vaginoplasty, and satisfaction with sexual activity was more associated with neoclitoral function than neovaginal depth.⁸¹ Further research on sexuality and sexual health after gender-affirming surgery is needed.

9. Patient-reported outcomes

Subjective outcomes such as degree of dysphoria, overall quality of life (QoL), and individuals' satisfaction are among the most important outcomes of any gender-confirming operation, as these procedures are meant to allow TGD individuals to live more comfortably in their bodies.⁸² Recent systematic reviews on surgical techniques and outcomes of gGAS reveal high overall effectiveness but poor description of TGD individuals' reported outcomes and satisfaction, and lack studies that are valid for the TGD population after surgery.⁸³ In a systematic review and meta-analysis of vaginoplasty in transgender women, outcomes of overall satisfaction (93%), and satisfaction with functional outcomes (87%), aesthetic outcomes (90%), and sexual outcomes, such as the ability to orgasm (70%), are described.⁸⁴

Data regarding patient-reported outcomes is generally limited, both by the size and low number of studies, and by the means by which data is collected. Patient-Reported Outcome Measures (PROMs) are questionnaires used to assess broader patient perceptions, experiences, and quality of life and are ideally distributed to patients before and/or after an intervention. In gender-affirming care these may assess general satisfaction, overall QoL, gender dysphoria or other comorbid mental health conditions like depression and anxiety, and specific aesthetic and specific functional (e.g., urinary or sexual) outcomes.⁸² Use of PROMs shifts attention toward patients' subjective experience with care and allows for more patient-centered evaluation of treatment efficacy. Lack of PROMs validated for use in TGD individuals after gGAS has limited our understanding of efficacy of individual treatments, our ability to compare relative efficacy of treatments within a group, and our understanding of what TGD individuals value regarding gGAS pre- and postoperatively.

To date, PROMs used in gender-affirming surgery studies include: tools validated in TGD individuals but not specific for the effects of GAS, tools validated to report functional outcomes (urinary, sexual, and aesthetic) but not in TGD individuals, tools with incomplete validation for use in TGD individuals after GAS, and ad-hoc tools without validation for any purpose.⁸³ Early efforts to create validated PROMs for gender surgery are underway.⁸⁵

Videos

Simple Orchiectomy in Transgender Patients

Vaginoplasty

Tubularized Urachus-Peritoneal Hinge-Flap Vaginoplasty

Right Colon Vaginoplasty

References

- 1 Hehemann MC, Walsh TJ. Orchietomy as Bridge or Alternative to Vaginoplasty. *Urol Clin N Am.* 2019;46(4):505-510. doi:10.1016/j.ucl.2019.07.005
- 2 ☆ Butler, C, Dugi D.; AUA Updates Series Lesson 3: A Urologist's Guide to Caring for the Transfeminine Patient; American Urologic Association (AUA) Update Series, 2022
- 3 Shannon M. Smith, Nance Yuan, Jenna Stelmar, Michael Zaliznyak, Grace Lee, Catherine Bresee, Maurice M. Garcia, Penile and Scrotal Skin Measurements to Predict Final Vaginal Depth With Penile Inversion Vaginoplasty, *Sexual Medicine*, Volume 10, Issue 6, 2022, <https://authors.elsevier.com/sd/article/S2050116122000848>
- 4 ☆ Sineath RC, Butler C, Dy GW, Dugi D 3rd. Genital Hypoplasia in Gender-Affirming Vaginoplasty: Prior Orchietomy, Penile Length, and Other Factors to Guide Surgical Planning. *J Urol.* 2022 Aug 23:101097JU0000000000002900. doi: 10.1097/JU.0000000000002900. Epub ahead of print. PMID: 35998270.
- 5 H G, DR M. Genitalia. In: Vol II. 1st ed. Little, Brown and Company; n.d.:368-388.
- 6 Hage JJ, Karim RB, Laub DR. On the Origin of Pedicled Skin Inversion Vaginoplasty: Life and Work of Dr Georges Burou of Casablanca. *Annals of Plastic Surgery.* 2007;59(6):723. doi:10.1097/01.sap.0000258974.41516.bc
- 7 Shoureshi P, Dugi D. Penile Inversion Vaginoplasty Technique. *Urol Clin N Am.* 2019;46(4):511-525. doi:10.1016/j.ucl.2019.07.006
- 8 Coleman E, Bockting W, Botzer M, et al. Standards of Care for the Health of Transsexual, Transgender, and Gender-Nonconforming People, Version 7. Vol 13. 7th ed.; 2012. doi:10.1080/15532739.2011.700873
- 9 Rinker B. The Evils of Nicotine: An Evidence-Based Guide to Smoking and Plastic Surgery. *Ann Plas Surg.* 2013;70(5):599. doi:10.1097/sap.0b013e3182764fc
- 10 Rollins KE, Varadhan KK, Dhatariya K, Lobo DN. Systematic review of the impact of HbA1c on outcomes following surgery in patients with diabetes mellitus. *Clin Nutr.* 2016;35(2):308-316. doi:10.1016/j.clnu.2015.03.007

- 11 Baltzis D, Eleftheriadou I, Veves A. Pathogenesis and Treatment of Impaired Wound Healing in Diabetes Mellitus: New Insights. *Adv Ther*. 2014;31(8):817-836. doi:10.1007/s12325-014-0140-x
- 12 Massie JP, Morrison SD, Maasdam JV, Satterwhite T. Predictors of Patient Satisfaction and Postoperative Complications in Penile Inversion Vaginoplasty. *Plast Reconstr Surg*. 2018;141(6):911e. doi:10.1097/prs.0000000000004427
- 13 Pariser JJ, Kim N. Transgender vaginoplasty: techniques and outcomes. *Transl Androl Urology*. 2019;8(3):241-247. doi:10.21037/tau.2019.06.03
- 14 Buncamper ME, Sluis WB van der, Pas RS van der, et al. Surgical Outcome after Penile Inversion Vaginoplasty: A Retrospective Study of 475 Transgender Women. *Plastic and Reconstructive Surgery*. 2016;138(5):999. doi:10.1097/prs.0000000000002684
- 15 Giori NJ, Ellerbe LS, Bowe T, Gupta S, Harris AHS. Many Diabetic Total Joint Arthroplasty Candidates Are Unable to Achieve a Preoperative Hemoglobin A1c Goal of 7% or Less. *J Bone Jt Surg Am*. 2014;96(6):500. doi:10.2106/jbjs.l.01631
- 16 Wilson JA, Clark JJ. Obesity: Impediment to Postsurgical Wound Healing. *Adv Skin Wound Care*. 2004;17(8):426. doi:10.1097/00129334-200410000-00013
- 17 Massie JP, Morrison SD, Maasdam JV, Satterwhite T. Predictors of Patient Satisfaction and Postoperative Complications in Penile Inversion Vaginoplasty. *Plast Reconstr Surg*. 2018;141(6):911e. doi:10.1097/prs.0000000000004427
- 18 Ives GC, Fein LA, Finch L, et al. Evaluation of BMI as a Risk Factor for Complications following Gender-affirming Penile Inversion Vaginoplasty. *Plastic Reconstr Surg - Global Open*. 2019;7(3):e2097. doi:10.1097/gox.0000000000002097
- 19 Tomiyama AJ, Hunger JM, Nguyen-Cuu J, Wells C. Misclassification of cardiometabolic health when using body mass index categories in NHANES 2005-2012. *Int J Obes (Lond)*. 2016 May;40(5):883-6. doi: 10.1038/ijo.2016.17. Epub 2016 Feb 4. PMID: 26841729.
- 20 Gotto GT, Yunis LH, Vora K, Eastham JA, Scardino PT, Rabbani F. Impact of Prior Prostate Radiation on Complications After Radical Prostatectomy. *J Urology*. 2010;184(1):136-142. doi:10.1016/j.juro.2010.03.031
- 21 Kuhn A, Hiltebrand R, Birkhäuser M. Do transsexuals have micturition disorders? *European Journal of Obstetrics & Gynecology and Reproductive Biology*. 2007;131(2):226-230. doi:10.1016/j.ejogrb.2006.03.019

- 22 Jiang D, Witten J, Berli J, Dugi D. Does Depth Matter? Factors Affecting Choice of Vulvoplasty Over Vaginoplasty as Gender-Affirming Genital Surgery for Transgender Women. *J Sex Medicine*. 2018;15(6):902-906. doi:10.1016/j.jsxm.2018.03.085
- 23 Garcia MM, Shen W, Zhu R, et al. Use of right colon vaginoplasty in gender affirming surgery: proposed advantages, review of technique, and outcomes. *Surg Endosc*. Published online 2020:1-12. doi:10.1007/s00464-020-08078-2
- 24 Garcia MM. Sexual Function After Shallow and Full-Depth Vaginoplasty: Challenges, Clinical Findings, and Treatment Strategies—Urologic Perspectives. *Clin Plast Surg*. 2018;45(3):437-446. doi:10.1016/j.cps.2018.04.002
- 25 Jiang D, Witten J, Berli J, Dugi D. Does Depth Matter? Factors Affecting Choice of Vulvoplasty Over Vaginoplasty as Gender-Affirming Genital Surgery for Transgender Women. *J Sex Medicine*. Published online 2018. doi:10.1016/j.jsxm.2018.03.085
- 26 Sluis WB van der, Steensma TD, Timmermans FW, et al. Gender-Confirming Vulvoplasty in Transgender Women in the Netherlands: Incidence, Motivation Analysis, and Surgical Outcomes. *J Sex Medicine*. 2020;17(8):1566-1573. doi:10.1016/j.jsxm.2020.04.007
- 27 Sharp G, Tiggemann M. Educating women about normal female genital appearance variation. *Body Image*. 2016;16:70-78. doi:10.1016/j.bodyim.2015.11.006
- 28 Suchak T, Hussey J, Takhar M, Bellringer J. Postoperative trans women in sexual health clinics: managing common problems after vaginoplasty. *Journal of Family Planning and Reproductive Health Care*. 2015;41(4):jfprhc-2014-101091. doi:10.1136/jfprhc-2014-101091
- 29 Lawrence AA. Patient-Reported Complications and Functional Outcomes of Male-to-Female Sex Reassignment Surgery. *Archives of Sexual Behavior*. 2006;35(6):717-727. doi:10.1007/s10508-006-9104-9
- 30 Faurschou A, Haedersdal M. Laser and IPL Technology in Dermatology and Aesthetic Medicine. Published online 2010:125-146. doi:10.1007/978-3-642-03438-1_9
- 31 D J, S G, L B, J B, D D. Implementation of a Pelvic Floor Physical Therapy Program for Transgender Women Undergoing Gender-Affirming Vaginoplasty. *Obstetrics and Gynecology*. 2019;133:1-10. doi:10.1097/aog.0000000000003236
- 32 Dy GW, Butler C, Peters B, Dugi DD 3rd. A Systematic Approach to Incision Planning and Graft Excision in Gender-affirming Vaginoplasty. *Plast Reconstr Surg Glob Open*. 2022 Feb 15;10(2):e4103. doi: 10.1097/GOX.0000000000004103. Erratum in: *Plast Reconstr Surg Glob Open*. 2022 Mar 28;10(3):e4280. PMID: 35186642; PMCID: PMC8846344.

- 33 Perovic SV, Djordjevic MLJ. The penile disassembly technique in the surgical treatment of Peyronie's disease. *BJU International*. 2001;88(7):731-738.
doi:10.1046/j.1464-4096.2001.01350.x
- 34 Soli M, Brunocilla E, Bertaccini A, Palmieri F, Barbieri B, Martorana G. ORIGINAL RESEARCH–SURGERY: Male to Female Gender Reassignment: Modified Surgical Technique for Creating the Neoclitoris and Mons Veneris. *The Journal of Sexual Medicine*. 2008;5(1):210-216. doi:10.1111/j.1743-6109.2007.00632.x
- 35 Bouman FG. Sex Reassignment Surgery in Male to Female Transsexuals. *Ann Plas Surg*. 1988;21(6):526-531. doi:10.1097/00000637-198812000-00006
- 36 Brown J. Creation of a functional clitoris and aesthetically pleasing introitus in sex conversion. In: Marchac D, Hueston JT, editors. *Transactions of the Sixth International Congress of Plastic and Reconstructive Surgery*. Paris, France: Masson; 1976. pp. 654–655
- 37 Hage JJ, Karim RB, Bloem JJAM, Suliman HM, Alphen M van. Sculpturing the Neoclitoris in Vaginoplasty for Male-to-Female Transsexuals. *Plast Reconstr Surg*. 1994;93(2):558. doi:10.1097/00006534-199402000-00021
- 38 Hage JJ, Karim RB. Sensate Pedicled Neoclitoroplasty for Male Transsexuals. *Ann Plas Surg*. 1996;36(6):621-624. doi:10.1097/00000637-199606000-00010
- 39 Selvaggi G, Ceulemans P, Cuypere GD, et al. Gender Identity Disorder: General Overview and Surgical Treatment for Vaginoplasty in Male-to-Female Transsexuals. *Plastic and Reconstructive Surgery*. 2005;116(6):135e. doi:10.1097/01.prs.0000185999.71439.06
- 40 Shih C, Cold CJ, Yang CC. Cutaneous Corpuscular Receptors of the Human Glans Clitoris: Descriptive Characteristics and Comparison with the Glans Penis. *The Journal of Sexual Medicine*. 2013;10(7):1783-1789. doi:10.1111/jsm.12191
- 41 Verkauf BS, Von Thron J, O'Brien WF. Clitoral size in normal women. *Obstet Gynecol*. 1992 Jul;80(1):41-4. PMID: 1603495.
- 42 Lawrence AA. Patient-Reported Complications and Functional Outcomes of Male-to-Female Sex Reassignment Surgery. *Archives of Sexual Behavior*. 2006;35(6):717-727. doi:10.1007/s10508-006-9104-9
- 43 Dreher PC, Edwards D, Hager S, et al. Complications of the neovagina in male?to?female transgender surgery: A systematic review and meta?analysis with discussion of management. *Clin Anat*. 2018;31(2):191-199. doi:10.1002/ca.23001

- 44 Karim RB, Hage JJ, Bouman FG, Dekker JJML. The Importance of Near Total Resection of the Corpus Spongiosum and Total Resection of the Corpora Cavernosa in the Surgery of Male to Female Transsexuals. *Ann Plas Surg.* 1991;26(6):554-557.
doi:10.1097/00000637-199106000-00010
- 45 Opsomer D, Gast KM, Ramaut L, et al. Creation of Clitoral Hood and Labia Minora in Penile Inversion Vaginoplasty in Circumcised and Uncircumcised Transwomen. *Plast Reconstr Surg.* 2018;142(5):729e. doi:10.1097/prs.0000000000004926
- 46 Young HH. Conservative perineal prostatectomy: presentation of new instruments and technic. *Journal of the American Medical Association.* Published online 1903.
- 47 ☆ MELMAN A, BOCZKO J, FIGUEROA J, LEUNG AC. Critical Surgical Techniques for Radical Perineal Prostatectomy. *The Journal of Urology.* 2004;171(2):786-790.
doi:10.1097/01.ju.0000107834.23316.59
- 48 Garcia, M.M., Harmon, D., Topp, K.; The Anatomy of Gender Affirming Genital Surgery Gray's Anatomy: The Anatomical Basis of Clinical Practice Susan Standring, 41st edition, 2017
Published by Elsevier ISBN-13: 9780702052309
- 49 Buncamper ME, Sluis WB van der, Vries M de, Witte BI, Bouman M-B, Mullender MG. Penile Inversion Vaginoplasty with or without Additional Full-Thickness Skin Graft: To Graft or Not to Graft? *Plastic and Reconstructive Surgery.* 2017;139(3):649e.
doi:10.1097/PRS.0000000000003108
- 50 Hage JJ, Karim RB. Abdominoplastic Secondary Full-Thickness Skin Graft Vaginoplasty for Male-to-Female Transsexuals. *Plast Reconstr Surg.* 1998;101(6):1512-1515.
doi:10.1097/00006534-199805000-00013
- 51 Thakar HJ, Dugi DD. Practical Plastic Surgery: Techniques for the Reconstructive Urologist. In: Brandes, S, Morey, A, eds. 2nd ed. Humana Press; 2013:69-82.
doi:10.1007/978-1-4614-7708-2_6
- 52 Stanojevic DS, Djordjevic ML, Milosevic A, et al. Sacrospinous Ligament Fixation for Neovaginal Prolapse Prevention in Male-to-Female Surgery. *Urology.* 2007;70(4):767-771.
doi:10.1016/j.urology.2007.06.1086
- 53 Dy GW, Kaoutzanis C, Zhao L, Bluebond-Langner R. Technical Refinements of Vulvar Reconstruction in Gender-Affirming Surgery. *Plast Reconstr Surg.* 2020;145(5):984e-987e.
doi:10.1097/prs.0000000000006796
- 54 Buncamper ME, Sluis WB van der, Pas RS van der, et al. Surgical Outcome after Penile Inversion Vaginoplasty: A Retrospective Study of 475 Transgender Women. *Plastic and Reconstructive Surgery.* 2016;138(5):999. doi:10.1097/PRS.0000000000002684

- 55 Peters BR, Martin LH, Butler C, Dugi D, Dy GW. Robotic Peritoneal Flap vs. Perineal Penile
Inversion Techniques for Gender-Affirming Vaginoplasty. *Curr Urol Rep.* 2022 Aug 30. doi:
10.1007/s11934-022-01106-9. Epub ahead of print. PMID: 36040679.
- 56 ☆ Gargollo PC. Hidden Incision Endoscopic Surgery: Description of Technique, Parental
Satisfaction and Applications. *J Urology.* 2011;185(4):1425-1431.
doi:10.1016/j.juro.2010.11.054
- 57 Castanon CDG, Matic S, Bizic M, Stojanovic B, Bencic M, Grubor N, Pusica S, Korac G,
Djordjevic ML. Laparoscopy Assisted Peritoneal Pull-Through Vaginoplasty in Transgender
Women. *Urology.* 2022 Aug;166:301-302. doi: 10.1016/j.urology.2022.05.001. Epub 2022 May
10. PMID: 35550383.
- 58 ☆ Yuan, N., Gupta, A., and Garcia, M.M.; An alternative option for gender-affirming revision
vaginoplasty: The tubularized urachus-peritoneal hinge flap; *Journal of Urology* Vol. 206, No.
Supplement 3, September 1, 2021
- 59 Smith, et al, An Alternative Option for Gender-Affirming Revision Vaginoplasty: The Tubularized
Urachus-Peritoneal Hinge Flap; *Sexual Medicine*, Sept 2022
- 60 Imparato E, Alfei A, Aspesi G, Meus AL, Spinillo A. Long-term results of sigmoid vaginoplasty in
a consecutive series of 62 patients. *Int Urogynecol J.* 2007;18(12):1465-1469.
doi:10.1007/s00192-007-0358-0
- 61 Kim C, Campbell B, Ferrer F. Robotic Sigmoid Vaginoplasty: A Novel Technique. *Urology.*
2008;72(4):847-849. doi:10.1016/j.urology.2008.04.004
- 62 Bouman M, Zeijl MCT, Buncamper ME, Meijerink WJHJ, Bodegraven AA, Mullender MG.
Intestinal Vaginoplasty Revisited: A Review of Surgical Techniques, Complications, and Sexual
Function. *J Sex Medicine.* 2014;11(7):1835-1847. doi:10.1111/jsm.12538
- 63 Sluis WB van der, Tuynman JB, Meijerink WJHJ, Bouman M-B. Laparoscopic Intestinal
Vaginoplasty in Transgender Women An Update on Surgical Indications, Operative Technique,
Perioperative Care, and Short- and Long-Term Postoperative Issues. *Urol Clin N Am.*
2019;46(4):527-539. doi:10.1016/j.ucl.2019.07.007
- 64 Sluis WB van der, Bouman M-B, Boer NKH de, et al. Long-Term Follow-Up of Transgender
Women After Secondary Intestinal Vaginoplasty. *J Sex Medicine.* 2016;13(4):702-710.
doi:10.1016/j.jsxm.2016.01.008
- 65 Neto RR, Hintz F, Krege S, Rübben H, Dorp F vom. Gender reassignment surgery - a 13 year
review of surgical outcomes. *International braz j urol.* 2012;38(1):97-107.
doi:10.1590/S1677-55382012000100014

- 66 Horbach S, Bouman M, Smit J, Özer M, Buncamper ME, Mullender MG. Outcome of
Vaginoplasty in Male?to?Female Transgenders: A Systematic Review of Surgical Techniques.
The Journal of Sexual Medicine. 2015;12(6):1499-1512. doi:10.1111/jsm.12868
- 67 Dy GW, Salibian AA, Blasdel G, Zhao LC, Bluebond-Langner R. External Genital Revisions
after Gender-Affirming Penile Inversion Vaginoplasty: Surgical Assessment, Techniques, and
Outcomes. Plast Reconstr Surg. 2022 Jun 1;149(6):1429-1438. doi:
10.1097/PRS.0000000000009165. Epub 2022 Apr 15. PMID: 35426889.
- 68 Hadj-Moussa M, Ohl DA, Kuzon WM. Feminizing Genital Gender-Confirmation Surgery. Sex
Medicine Rev. Published online 2018. doi:10.1016/j.sxmr.2017.11.005
- 69 Hoebeka P, Selvaggi G, Ceulemans P, et al. Impact of Sex Reassignment Surgery on Lower
Urinary Tract Function. Eur Urol. 2005;47(3):398-402. doi:10.1016/j.eururo.2004.10.008
- 70 Melloni C, Melloni G, Rossi M, et al. Lower Urinary Tract Symptoms in Male-to-Female
Transsexuals. Plastic Reconstr Surg - Global Open. 2016;4(3S):e655.
doi:10.1097/gox.0000000000000635
- 71 Haseth KB de, Buncamper ME, Özer M, et al. Symptomatic Neovaginal Candidiasis in
Transgender Women After Penile Inversion Vaginoplasty: A Clinical Case Series of Five
Consecutive Patients. Transgender Heal. 2018;3(1):105-108. doi:10.1089/trgh.2017.0045
- 72 Weyers S, Verstraelen H, Gerris J, et al. Microflora of the penile skin-lined neovagina of
transsexual women. Bmc Microbiol. 2009;9(1):102. doi:10.1186/1471-2180-9-102
- 73 Crann SE, Cunningham S, Albert A, Money DM, O'Doherty KC. Vaginal health and hygiene
practices and product use in Canada: a national cross-sectional survey. Bmc Women's Heal.
2018;18(1):52. doi:10.1186/s12905-018-0543-y
- 74 Dy GW, Jun MS, Blasdel G, Bluebond-Langner R, Zhao LC. Outcomes of Gender Affirming
Peritoneal Flap Vaginoplasty Using the Da Vinci Single Port Versus Xi Robotic Systems. Eur
Urol. Published online 2020. doi:10.1016/j.eururo.2020.06.040
- 75 ☆ Jacoby A, Maliha S, Granieri MA, et al. Robotic Davydov Peritoneal Flap Vaginoplasty for
Augmentation of Vaginal Depth in Feminizing Vaginoplasty. J Urology. 2019;201(6):1171-1176.
doi:10.1097/ju.000000000000107
- 76 Acar O, Sofer L, Dobbs RW, et al. Single Port and Multi-Port Approaches for Robotic
Vaginoplasty with the Davydov Technique. Urology. Published online 2020.
doi:10.1016/j.urology.2019.11.043

- 77 Sluis WB van der, Bouman M-B, Meijerink WJHJ, et al. Diversion neovaginitis after sigmoid vaginoplasty: endoscopic and clinical characteristics. *Fertil Steril*. 2016;105(3):834-839.e1. doi:10.1016/j.fertnstert.2015.11.013
- 78 Claes KEY, Pattyn P, D'Arpa S, Robbins C, Monstrey SJ. Male-to-Female Gender Reassignment Surgery Intestinal Vaginoplasty. *Clin Plast Surg*. Published online 2018. doi:10.1016/j.cps.2018.03.006
- 79 Selvaggi G, Monstrey S, Ceulemans P, T'Sjoen G, Cuypere GD, Hoebeke P. Genital Sensitivity After Sex Reassignment Surgery in Transsexual Patients. *Ann Plas Surg*. 2007;58(4):427. doi:10.1097/01.sap.0000238428.91834.be
- 80 Lawrence AA. Sexuality Before and After Male-to-Female Sex Reassignment Surgery. *Archives of Sexual Behavior*. 2005;34(2):147-166. doi:10.1007/s10508-005-1793-y
- 81 Hess J, Henkel A, Bohr J, et al. Sexuality after Male-to-Female Gender Affirmation Surgery. *Biomed Res Int*. 2018;2018:1-7. doi:10.1155/2018/9037979
- 82 Dy GW, Nolan IT, Hotaling J, Myers JB. Patient reported outcome measures and quality of life assessment in genital gender confirming surgery. *Transl Androl Urology*. 2019;8(3):228-240. doi:10.21037/tau.2019.05.04
- 83 Andréasson M, Georgas K, Elander A, Selvaggi G. Patient-Reported Outcome Measures Used in Gender Confirmation Surgery. *Plast Reconstr Surg*. 2018;141(4):1026-1039. doi:10.1097/prs.0000000000004254
- 84 Manrique OJ, Adabi K, Martinez-Jorge J, Ciudad P, Nicoli F, Kiranantawat K. Complications and Patient-Reported Outcomes in Male-to-Female Vaginoplasty—Where We Are Today: A Systematic Review and Meta-Analysis. *Ann Plas Surg*. 2018;80(6):684. doi:10.1097/sap.0000000000001393
- 85 Klassen AF, Kaur M, Johnson N, et al. International phase I study protocol to develop a patient-reported outcome measure for adolescents and adults receiving gender-affirming treatments (the GENDER-Q). *Bmj Open*. 2018;8(10):e025435. doi:10.1136/bmjjopen-2018-025435