

Perspective

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Surgical considerations for genital reconstruction options for gender-diverse individuals assigned male at birth

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Abstract

Information available on gender-affirming surgeries is often limited to those classified by the binary standard of masculinizing or feminizing genital aesthetics. Scant information is available on surgical options for non-binary and gender-diverse individuals who may opt for less frequently requested surgeries. We discuss preoperative counseling, surgical techniques, and postoperative care of such procedures, including a discussion of scrotoectomy, penile-sparing vaginoplasty, and nullification procedures for non-binary and gender-diverse individuals assigned male at birth (AMAB). Frequent and open discussions are key to helping manage expectations of surgical outcomes. Creating an inclusive and safe environment is pivotal in understanding the needs and goals of all gender-diverse patients.

Keywords: Nullification, penile sparing vaginoplasty, scrotoectomy, gender diverse

INTRODUCTION

Over the last decade, there has been an increase in the number of gender-affirming surgeries (GAS) performed. Recent data on temporal trends on GAS in the United States (U.S.) suggest that the number has nearly tripled from 2016 to 2019^[1]. Genital reconstruction is the second most common GAS in a cohort of



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nearly 50,000 patients^[1]. Notably, GAS were originally classified by the binary standard of feminizing or masculinizing surgeries due to our limited understanding of gender identity^[2]. With a more improved understanding of gender as a spectrum, GAS may include a wider scope of procedures beyond the traditional gender binary, aiming to modify sex characteristics to better align with an individual's experienced gender identity. While our understanding of gender identity has improved, the discussions surrounding the preferred surgical options for gender-diverse patients remain limited.

As of 2021, there are an estimated 1.2 million adults in the U.S. who identify as nonbinary, with an increasing number choosing to pursue surgery due to increased access to care^[3,4]. A recent retrospective study of a cohort of non-binary adults reported that over half either received or were interested in receiving GAS^[5]. Despite these trends, there is limited information and discussion on surgical considerations for gender-diverse individuals, which may involve a combination of reconstruction and the removal of less desired genitalia. Two less commonly discussed surgeries are nullification and penile sparing vaginoplasty (PSV). Nullification refers to the excision of genitalia typically associated with the binary sexes (e.g., labia, penis, testicles, scrotum), resulting in a more neutral physical appearance. PSV, on the other hand, allows patients to retain a functional penis while also constructing a functional vaginal canal. Individuals may opt for these surgical options based on unique personal or anatomical priorities that best align with their gender identity and sexual preferences.

Given the paucity of information and the limited number of reported cases, we aim to provide an initial framework for discussing the provision of less frequently requested GAS for gender-diverse individuals assigned male at birth (AMAB). We outline the counseling strategies, surgical techniques, and postoperative care protocols practiced at our institution. In doing so, we seek to highlight the importance of open communication in ensuring patient comfort, safety, and satisfaction throughout the process.

PREOPERATIVE COUNSELING

The TGD community has historically faced pervasive discrimination, rejection, and even violence within the medical system^[6]. A 2012 study conducted by Harvard Kennedy School found that trans-identifying patients experienced medical care refusal at a rate of 14%-20%^[7]. Understandably, there is a deep distrust of the medical community - an issue with potentially dire consequences when patients are navigating complex and life-altering endeavors such as genital-affirming surgery. To promote patient safety and achieve optimal health outcomes, healthcare providers should make special efforts to build rapport and trust with their patients^[8]. One suggested approach is the use of a trauma-informed care (TIC) approach^[9,10]. TIC acknowledges that many patients have experienced trauma from various sources and seeks to adapt care systems to be responsive to those experiences. It offers practical strategies for breaking down barriers and fostering trust, including patient-centered communication, an understanding of the health impacts of trauma, and awareness of one's own implicit biases.

While the field of gender-affirming care has made significant strides in the past decades, it has long been practiced under a binary standard - presuming that individuals seeking gender affirmation are transforming from one gender to another^[11]. This perspective reflects a White Western view of gender, overlooking the needs of non-binary individuals and people of color (POC) communities, who may hold more inclusive gender perspectives^[11]. With this awareness, the author's institution approaches preoperative counseling for GAS with the goal of creating a safe and inclusive environment that enables patients to articulate their goals for surgery.

Approach

The TIC approach should be kept in mind during preoperative counseling to help foster open patient-provider communication. Open and frequent conversations on goals for surgery help manage expectations and build trust. There is a limited body of research on health literacy within the transgender and nonbinary community; however, recent studies indicate that, although their health literacy levels tend to be lower than the general population, individuals within this community actively engage in efforts to improve their health literacy^[12,13]. Key facilitators of enhanced health literacy include positive interactions with healthcare providers and staff, as well as the use of inclusive forms and processes^[12]. Pre-surgical counseling should be utilized to establish rapport and create a safe, inclusive environment where patients can be presented with their options in a clear and comprehensible manner. This approach may involve the use of accessible visual aids (e.g., video, illustration, etc.), written educational materials, multiple follow-up visits to reinforce information, involving members of the patient's support network, and employing the teach-back method to ensure comprehension.

When consulting any individual seeking gender-affirming surgery, it is important to maintain an open mind. Based on established principles for gender-affirming care^[14], we recommend three general principles to best understand what fits the patient and their goals:

1. Unbiased perspective.
2. Present ALL options.
3. Thorough intake.

An unbiased perspective

The harmful effects of implicit bias are well documented. We know that it can further lead to health disparities and distrust^[15]. Therefore, the initial consultation should be approached with an unbiased perspective. Removing one's perspective can foster a more open-ended and honest conversation and help establish rapport with the patient. It is best to avoid making assumptions about the surgery an individual may seek based on one's appearance or identity^[14]. Such assumptions can be damaging to the patient, the patient-physician relationship, and negatively impact the patient's satisfaction with the surgical outcome.

Present all options

Many individuals seeking GAS may not be aware of all the options available to them. A qualitative study on perioperative transgender patient experiences reported that while all of them had done extensive online research and talked to friends or other individuals who have gone through GAS, the perioperative visit was considered the most useful source of information regarding understanding, expectations, procedural details, and complications^[16]. Orchiectomy/scrotoectomy, PSV, and nullification surgery are not exclusive to non-binary or gender-diverse individuals, just as vaginoplasty or vulvoplasty procedures are not exclusively sought by trans feminine patients. Presenting all options allows folks to select a surgery that serves their best interest and protects patient autonomy. The author suggests offering a detailed description of each procedure when presenting the options. Additionally, incorporating illustrations and/or previously approved example photographs can enhance comprehension.

Thorough intake

Patient history is another important component that influences whether a surgical technique is feasible and can help better guide patients to a safer and successful outcome. We recommend that a medical and surgical history be obtained, as well as specific surgical goals and priorities. At this institution, patients complete a specialized intake form for bottom surgery, which includes gathering baseline information on urinary and

sexual function. The form also asks patients to rate the significance of various surgical goals that may be included in gender-affirming surgery. Gender fluidity can manifest in a multitude of ways and impact patient goals. For example, one may encounter an individual who does not want to rely on exogenous hormones and therefore wants to maintain their native sex hormone-producing organ (i.e., testes or ovary). Other individuals may desire anatomy that allows them to maintain the ability to have penetrative sex with their penis while experiencing penetrative vaginal sex. Many individuals may not be interested in penetrative sex or prefer not to engage in any kind of sex at all and, therefore, do not want to pursue a surgery that has certain risks or requires too much maintenance. Similarly, aesthetics may be important to some, while others may consider the functional component more of a priority.

A key component of intake is assessing readiness for surgery. In addition to physical health, lifestyle factors can equally impact recovery and the surgical outcome. Ensuring the patient has a support system and safe recovery location is vital. A study on quality of life after gender-affirming care found higher reported scores on quality of life in the immediate postoperative period after GAS in those with a greater network of social support^[17]. Emotional responses to these types of altering surgeries can vary, and therefore, it is critical for there to be support in place to help one navigate any potential difficulties. Understandably, not everyone has access to a direct support system, and having a member of the team dedicated to directing patients to available local resources is an important need. An effective way of addressing this is by applying a multidisciplinary approach. The World Professional Association for Transgender Health (WPATH) Standard of Care (SOC) Version 8 emphasizes the utility of a multidisciplinary approach, particularly when it comes to more “customizable” GAS^[18]. Oregon Health Science University discusses its use of a multidisciplinary approach for GAS, particularly for less commonly sought procedures, and reports that this approach fosters a more inclusive and informed environment^[19]. This institution’s approach for those seeking GAS is also to provide a multidisciplinary experience. Every patient seeking surgery meets with a social worker to identify any additional needs prior to surgery (e.g., mental health services, finances, housing, *etc.*). If deemed appropriate, patients are discussed at our monthly disciplinary meeting, which includes primary care, social work, and mental health services. It is then determined if additional resources, help, or workup are required prior to proceeding with surgery. We have found that this has led to a more comprehensive and supportive care plan before surgery and allows for patients and providers to make an informed, safe, and appropriate shared decision regarding surgical treatment.

Risks and benefits

Effective counseling includes a discussion of the risks, benefits, and alternatives, all summarized in [Table 1](#). When discussing the risks and benefits of these specific surgeries, it is crucial to acknowledge the limited outcome data available for many of these surgeries, given their infrequent occurrences. Our discussion of pros and cons is based on our limited experience with these specific cases, as well as the outcomes of related cases observed in cancer, trauma, and reconstructive surgeries.

Scrotoectomy is the removal of the scrotal skin. This surgery can be performed concurrently with an orchiectomy or subsequently. A scrotoectomy allows for a flatter appearance of the perineum, and often excises dysphoric anatomy, while preserving a functional penis for sexual and urinary purposes. Surgical risks are often low, but may include wound separation and, in rare occurrences, urethral injury if the dissection is carried too deep^[20]. Orchiectomy can result in erectile dysfunction, while removal of excessive scrotal tissue can result in an acquired buried penis, which may be aesthetically and functionally unpleasant^[21]. The surgeon should highlight that a scrotoectomy can preclude patients from seeking a successful vulvoplasty or vaginoplasty in the future, as the tissue preserved for labial construction and vaginal lining would have been discarded. It is ill-advised to perform this surgery in folks who are unsure or may be considering future vulvar or canal reconstruction.

Table 1. Overview of the benefits, risks and considerations of surgical options for gender-diverse individuals assigned male at birth

Procedure	Description	Risks and considerations
Scrotoectomy	Removal of scrotal skin, preserving the penis	May limit future vulvoplasty/vaginoplasty; risk of urethral injury; risk of buried penis
Vulvoplasty	Creation of a vulva, no vaginal canal	No canal; may make canal creation down the line more difficult
PSV	Neovagina while keeping the penis	Aesthetic limits; may require skin grafting; greater surgical complexity results in a higher risk of complications (e.g., incontinence, fistula, erectile dysfunction); lifetime dilation
Nullification	Removal of external genitalia, allows for a neutral appearance	Irreversible; no aesthetic; potential pain; nerve-related complications

PSV: Penile sparing vaginoplasty.

Vulvoplasty

Vulvoplasty is more commonly known and has been previously described, but we wanted to include it as part of the surgical options. It refers to the surgical reconstruction of a vulva or more “feminized” external genitalia and excludes the construction of a vaginal canal^[22]. A vulvoplasty may be a suitable alternative to vaginoplasty for those who do not desire penetrative sex or wish to avoid the maintenance associated with a neovaginal canal (e.g., dilation). If a canal is desired later, it is possible to perform, but can be more challenging as the tissue generally reserved for lining the canal would have been discarded^[23]. Vulvoplasty is also an option for individuals who may not be a candidate for a neovaginal canal due to medical, mental, or social factors that place them at higher risk for complications^[24]. The advantages of a vulvoplasty include no need for preoperative hair removal, no required postoperative maintenance, a shorter hospital stay at this author’s institution, and fewer associated complications compared to vaginoplasty. In case of a complication, most are minor, and include urinary tract infection, small wound separation, or granulation tissue which can generally be managed non-surgically as an outpatient^[25,26]. Major complications are rare but can include urethral or rectal injury^[25]. The main disadvantage is that there is no functional canal.

PSV

A PSV is a surgical reconstruction of a neovagina with preservation of the penis. Limited literature exists thus far describing PSV. It is important for individuals interested in pursuing PSV to understand that a notable limitation of this technique is the aesthetic outcome and restrictions related to skin coverage. Since the natal penis is preserved, the penile skin cannot be used for reconstructive purposes, limiting the ability to achieve a vulvar-like aesthetic. Similarly, scrotal skin will need to be preserved for coverage of the perineum, and therefore there is limited scrotal skin available to cover the vaginal canal. Common options for canal coverage include the use of skin grafts, allografts, or peritoneum^[27]. Given the average surface area of a canal is about 13 cm in depth and 11 cm in circumference at this institution, a large graft would be required for complete coverage. Skin grafts can be cosmetically unfavorable, and allografts can be expensive^[28]. As a result, the author recommends a peritoneal approach to help augment the canal lining and minimize the need for skin graft harvesting. A peritoneal approach typically utilizes a robotic laparoscopic technique to harvest a peritoneal flap from over the bladder and rectum^[29]. A peritoneal vaginoplasty, however, does have the added risk of injuring intra-abdominal structures such as bowel, ureter, bladder, and rectum. Even with the use of the peritoneum, additional skin will be required to bridge the gap between the introitus at the perineum and peritoneal flap, which can be accomplished with either an extragenital skin graft or use of allograft^[29]. Further, canal dissection has the risk of injuring the urethra, rectum, and lateral pelvic nerves, which could lead to incontinence and/or fistula^[25,26]. More specifically, a cavernosal nerve injury during the canal dissection can lead to erectile dysfunction postoperatively. Lifelong vaginal dilation is required to decrease the risk of vaginal stenosis. Even so, vaginal stenosis may result and may require operative management with relaxing incisions^[26]. Notably, vaginal stenosis after PSV may prove to be more challenging to treat, given the initial tissue recruited for primary management. For complete stenosis, options for canal revision may be limited and even more risky.

Nullification

Nullification, to our knowledge, has not been well described in the literature. The surgery involves the removal of any binary-associated externalized genitalia and the creation of a more neutral appearance, resulting in a smooth transition from the abdomen to the groin. In those assigned males at birth, one must decide to preserve the neurovascular bundle of the penis to attempt to maintain sexual sensation. The approach in which nerve endings (i.e., glans) are managed (buried vs. left exposed) can also influence outcomes. For example, buried glans may be a nidus for infection if not de-epithelialized appropriately, or lead to discomfort, decreased, or dull sensation, while exposed glans will require consideration of placement to avoid irritation, dulled sensation, or bother^[30]. Careful consideration of how the neurovascular bundle is managed is crucial to mitigate any undesired sexual or chronic pain complications. Aesthetic considerations include midline versus lateral placement of the incisions. A midline incision may offer an easier closure but will leave a central scar. A lateral incision may distribute tension differently, potentially minimizing scar appearance, but risks asymmetric alignment. Further, a penectomy will eliminate the patient's ability to engage in penetrative sex with limited alternatives for reversal or future genitalia reconstruction.

Finally, it is pivotal to emphasize the irreversible nature of these procedures. While various studies report the prevalence of regret after GAS is < 1%, with only 8% of these being medical, effective counseling ensures patients make informed decisions^[31,32]. It is imperative that the patient and surgeon are aligned in the surgical goals and understanding of their surgical options before proceeding with surgery.

SURGICAL TECHNIQUE

Given the limited literature discussing these less frequently requested options, we choose to describe our surgical approach to these techniques, based on the author's experience. There are many considerations when choosing to embark on these options, and as was previously mentioned, it is important to review these considerations in detail. It should be noted that these are simply suggested approaches, as there are limited outcome-based data to indicate that one approach is superior to another.

Scrotoectomy

Figure 1 illustrates the approach to scrotoectomy. Scrotoectomy has been more commonly done in the setting of trauma or lymphedema^[20]. Given that testicles are absent or removed simultaneously, and there is usually minimal edema in this patient population, the suggested surgical approach to scrotoectomy is to make an elliptical incision around the scrotum such that the maximum amount of skin can be excised without putting too much tension on the wound once re-approximated [**Figure 1A**]. The elliptical incision helps to minimize "dog ears"^[33]. The skin and underlying subcutaneous tissue are removed, and the bilateral orchiectomy is performed. Only enough subcutaneous tissue and fat need to be removed to flatten the surface to the level of the adjacent perineum while avoiding over-dissecting and exposing the corpus spongiosum. The wound is then re-approximated at the midline in several layers to avoid any dead space and to help redistribute the tension off the wound [**Figure 1B**]. The scrotal skin is often fused with the penile shaft skin, and one should be mindful to avoid chasing the dog ear up the shaft and inadvertently removing too much penile shaft skin. This can be most effectively prevented by placing the penis on stretch, which can also reduce the risk of creating a closure that is too tight and minimize the downward tethering of the penis.

PSV

Figure 2 illustrates our suggested approach to PSV. Given that limited scrotal skin and no penile skin can be recruited for vaginal canal coverage, we suggest approaching a PSV in a similar fashion to the robotic

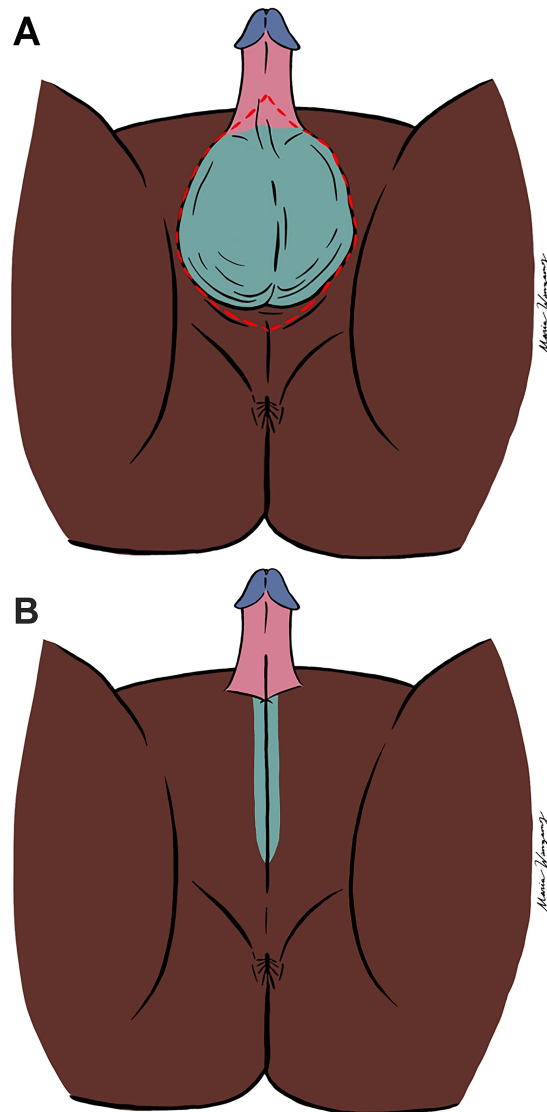


Figure 1. Scrotectomy. (A) an elliptical incision is made around the scrotal skin and extended to the proximal shaft; (B) the wound is re-approximated in several layers in the midline.

peritoneal vaginoplasty^[29]. Although one could opt to use skin grafts or allografts for canal coverage, a peritoneal approach minimizes the need for additional external tissue, while remaining both cosmetically favorable and cost-effective. It is believed that a robotic approach, compared to an open approach for the peritoneal flap harvest, would enable smaller incisions, less blood loss, and shorter hospitalization, much like what has been seen for prostatectomy surgery^[34]. PSV is approached by first palpating the perineal body, which serves as the base of the perineal flap. An incision is then made about 1 cm from the groin crease bilaterally, extending to the base of the perineal flap [Figure 2A]. Once the vulvar incision is made, the

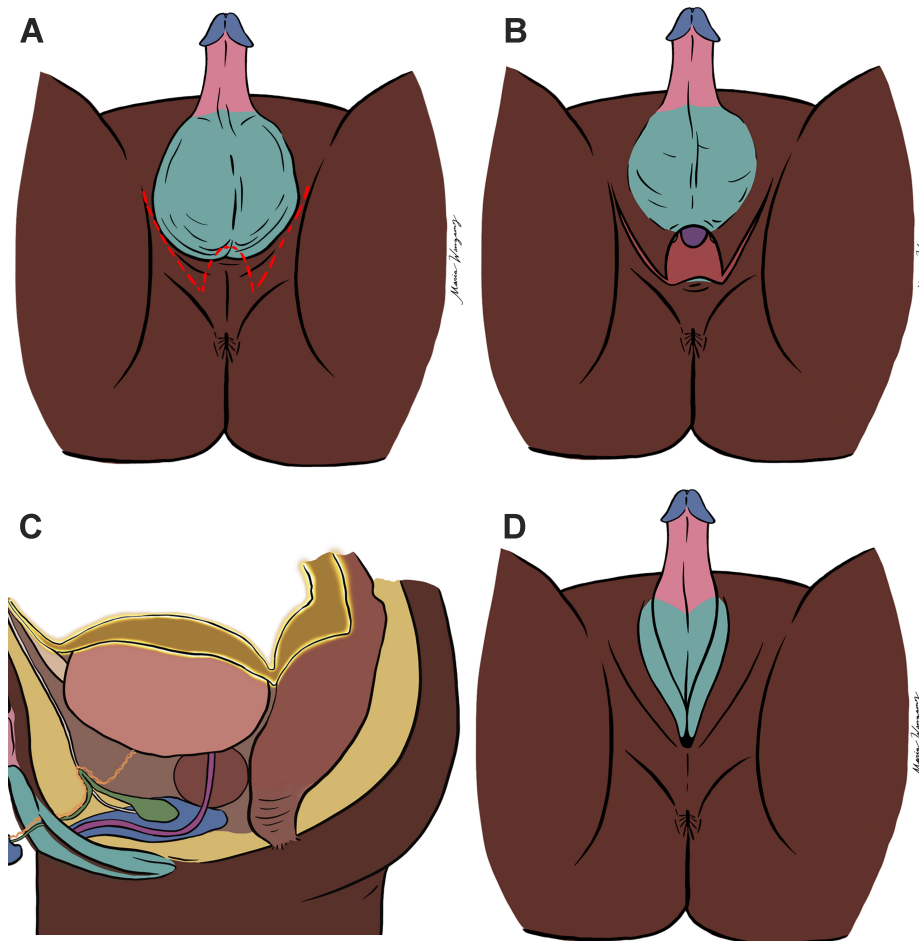


Figure 2. Penile Sparing Vaginoplasty. (A) Incise along groin crease; (B) Dissect through dartos tissue to remove testes and begin dissection under the urethra; (C) Intra-abdominally raise peritoneal flap over bladder/rectum; (D) External flaps are advanced toward the peritoneal edge.

scrotal tissue is kept with the wound so that it can be recruited for coverage of the perineum and vaginal introitus. The dissection is continued under the skin to perform the orchiectomy and begin the perineal dissection of the canal under the bulbospongiosus [Figure 2B]. Construction of the canal can be achieved by simultaneous perineal and intra-abdominal dissection [Figure 2C]. The scrotal skin is then advanced inward toward the peritoneal cut edge. Although some surgeons may select to solely use the peritoneum to line the canal, this institution's preference is to take the flap no higher than the superior aspect of the bladder to minimize the risk of compromising the quality and blood supply of the flap. Consequently, an additional skin graft or allograft may be needed to connect the external perineal skin to the peritoneal flap [Figure 2D]^[35]. Achieving any labial aesthetic can prove to be difficult as there is essentially no skin available to recruit and can be omitted.

Nullification

Figures 3 and 4 illustrate some suggested approaches to nullification for those AMAB. For those AMAB, a nullification procedure includes a penectomy, bilateral orchiectomy, and scrolectomy. A urethrostomy is created to facilitate easier voiding while sitting, similar to a perineal urethrostomy procedure^[36]. Nullification surgery can be done as a single or staged procedure. In a single procedure, it can be

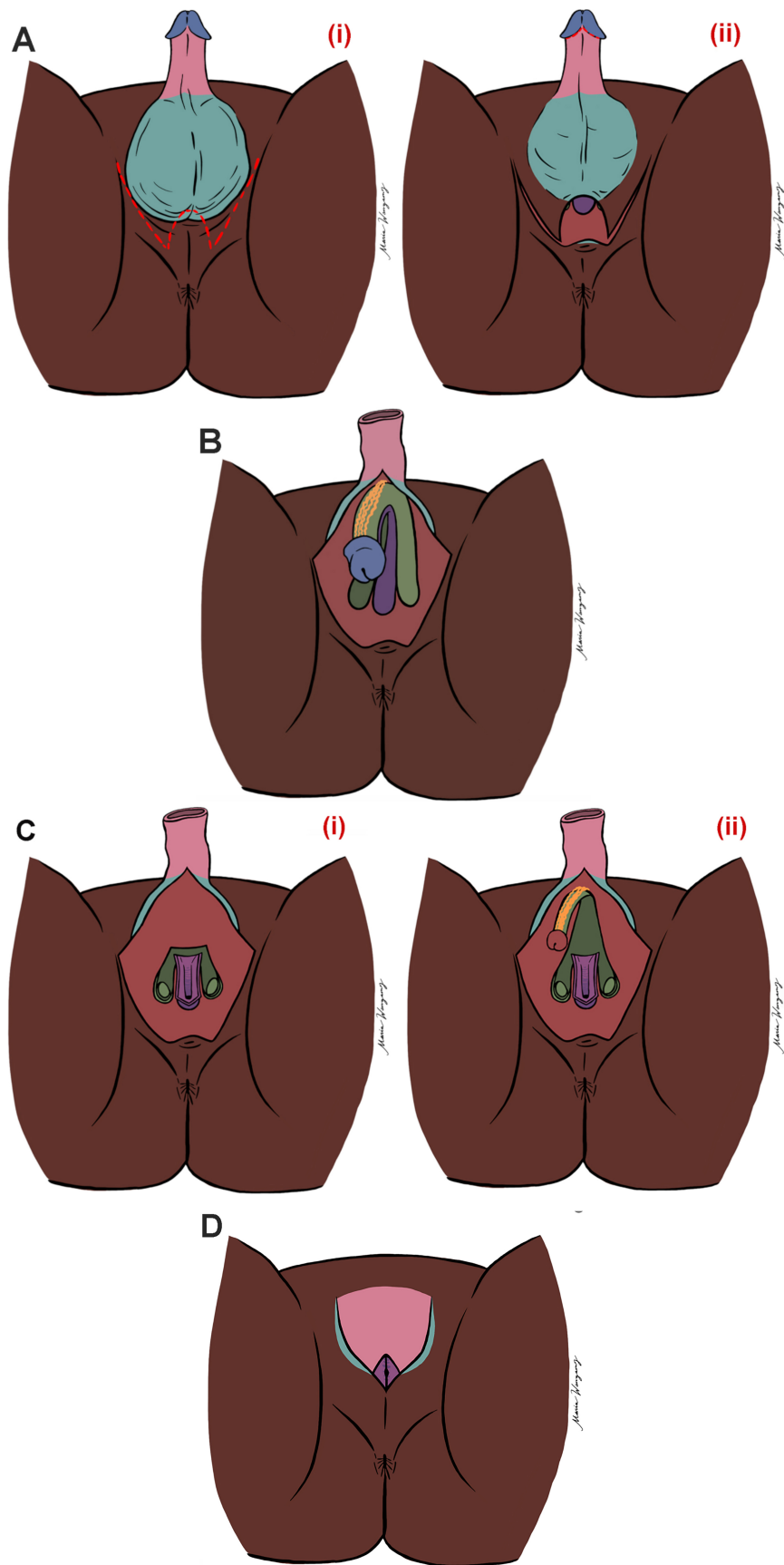


Figure 3. Nullification, option 1. [A(i) and (ii)]. Incise along groin crease and penile circumcision line; (B) Dissect through dartos tissue to remove testes and separate penile skin from underlying penile structures; [C(i)] Penectomy (preservation of tunica albuginea and nerve bundle, urethrectomy and spatulation of the urethra, [C(ii)] Option to perform complete penectomy (D). External flaps are advanced toward urethrotomy.

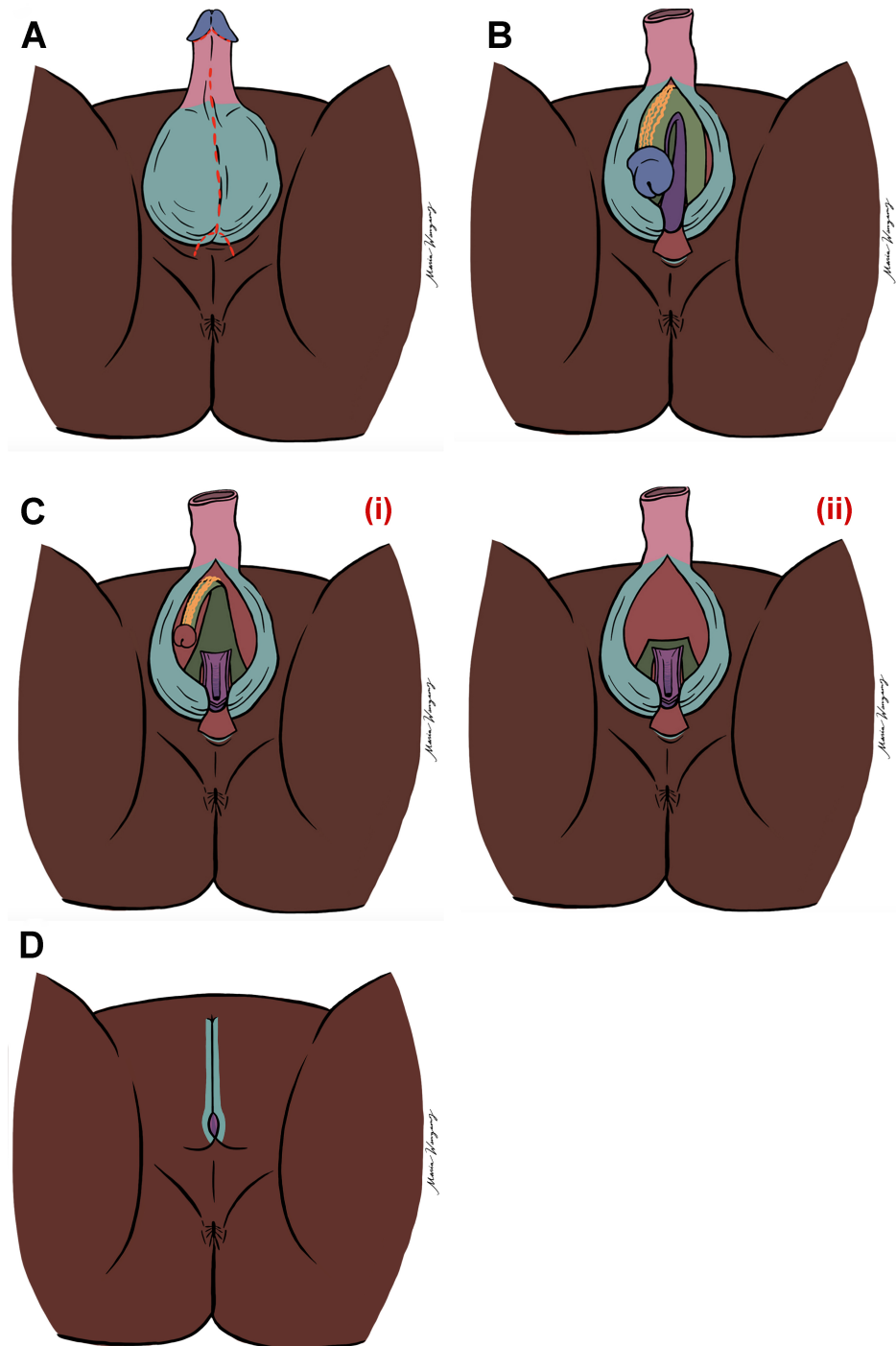


Figure 4. Option 2. (A) Incise midline; (B) Uncover underlying penile structures and perform orchiectomy; [C(i)] Penectomy (maintain tunica and nerve bundles), urethrectomy and spatulation of urethra to perineal urethrostomy; [C(ii)] Option to perform complete penectomy and not preserve nerves; (D) Closed in midline.

approached by either incising the midline or lateralizing the incisions. When lateralizing the incisions, the perineal body is palpated, a perineal flap is marked, and the wound is incised 1 cm from the groin crease [Figure 3A]. The dissection is continued through the dartos to perform the orchiectomy. A circumcising incision is made adjacent to the corona and the penile skin is separated from the skin tube. [Figure 3B]. Surgical considerations for nullification include whether to preserve nerves or not. If nerves are not preserved, the penis can be excised en bloc [Figure 3(i)]. If preserving nerves, then the penis can be deconstructed by opening the corpora, removing the spongy tissue, and keeping the nerves intact along the tunica [Figure 3(ii)]. The urethra is then shortened and spatulated to the point where the urethral opening is in line with the external sphincter. When preserving nerves, the glans can either be de-epithelialized and buried or can be matured to the surface of the wound^[36]. The penile skin tube is then advanced down towards the shortened urethra and re-approximated to the superior lateral urethra. The scrotal skin flaps are then advanced down towards the lateral edges to close the wound and the excess skin is excised [Figure 3D]. If a midline approach is taken, then the scrotum and penis are incised in the midline [Figure 4], and the orchiectomy, penectomy, and urethrostomy are performed in a similar fashion. The wound is re-approximated in the midline [Figure 4].

POSTOPERATIVE CARE

In the author's practice, patients undergoing scrotoectomy and nullification can be safely managed on an outpatient basis. Scrotoectomy patients typically have a single incision closed with absorbable sutures and skin glue. They are advised that the incision can take 4-6 weeks to fully heal. Nullification patients receive similar guidance but are discharged with a catheter in place for 72 h due to the urethrostomy. If a surgical drain is placed, it is kept until the output remains low (~less than 25 cc per day). Our postoperative management of PSV patients follows the same protocol as for primary vaginoplasty: inpatient bedrest for 5 days, vaginal packing, and dilation post packing removal. The expected healing time for PSV is 6-8 weeks.

CONCLUSION

Building a safe and inclusive environment enables patients to articulate their goals for surgery. Open conversations are vital for aligning surgical plans with patient needs and goals, as well as setting realistic expectations for aesthetic and functional outcomes. By addressing feasibility, comfort, and safety, surgeons can guide patients toward procedures that best align with their identities and goals. These efforts contribute to the holistic success of GAS, particularly for non-binary individuals seeking less common options.

DECLARATIONS

Authors' contributions

Made substantial contributions to conception, literature review, and manuscript content: Ramirez ML, Butler C

Contributed to the illustrations and figures: Wangamez M, Huynh R.

Availability of data and materials

All data relevant to the study are included in the article or uploaded as [Supplementary Materials](#).

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Conflicts of interest

All authors declared that there are no conflicts of interest.

Ethical approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

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