Original Article

Vaginoplasty: Maximizing aesthetic and functional outcomes of the vulva

ABSTRACT

Background: Gender-affirming vaginoplasty improves quality of life for transgender women. While techniques for canal creation vary, achieving aesthetic and functional vulvar outcomes is essential.

Objective: To review surgical techniques that optimize vulvar aesthetics in vaginoplasty, focusing on external genital reconstruction.

Methods: This review details incision design, clitoral and labial construction, sulcus definition, and urethral plate management. Techniques emphasize symmetry and customization based on patient preferences.

Results: Refined incisions and neurovascular preservation improve cosmetic outcomes. Defined labial contours and tailored posterior introitus construction reduce complications and support sexual function.

Conclusion: Aesthetic goals in vaginoplasty should be individualized. Technical precision and patient centered planning are key to achieving optimal outcomes.

Keywords: Gender-affirming, labiaplasty, vaginoplasty, vulva

INTRODUCTION

Background

Gender dysphoria is an incongruency in an individual's gender and that which was assigned at birth.[1] Treatment of gender dysphoria is highly individualized and tailored to the specific needs of each patient. Care for patients with gender dysphoria can include counseling and psychosocial support, medical therapy such as hormone replacement therapy or hormonal blockade, and gender-affirming surgeries (GAS).[2,3]

In the United States, approximately 1.6 million adults are transgender, representing 0.5% of the adult population. Within this population, 38.5% are estimated to be transgender females, 35.9% are transgender males, and 25.6% are gender non-binary.[4] Worldwide, it is estimated that there are 25 million transgender people.[1] These statistics likely under-represent the true population but underscore the large and growing population of patients who require transgender care. Regarding patients seeking GAS, there has been an increasing trend with the absolute number of GAS procedures in the United States from 4552 in 2016 to a peak of 13,011 in 2019.[5] As more patients seek surgery, there is a need to study and improve even more our surgical techniques.

For patients experiencing gender dysphoria who pursue gender-affirming vaginoplasty, a range of surgical techniques has been developed to meet the varied needs of each patient. These include penile inversion vaginoplasty (PIV),

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peritoneal flap vaginoplasty, bowel substitution vaginoplasty, and minimal depth vaginoplasty.[6,7] Not only does gender-affirming vaginoplasty reduce gender dysphoria, but it also improves the quality of life of the patient.[8-10] Achieving this goal requires an emphasis on both the aesthetic and functional outcomes of surgery. The variants in surgical technique for vaginoplasty primarily describe options for the creation of the vaginal canal; the surgical technique used for the creation of the vulva remains the same for these options. A satisfactory surgical result not only aligns the patient's physical characteristics with their gender identity but also ensures functionality that supports their overall well-being.[11] This manuscript reviews and discusses specific technical aesthetic aspects of a vaginoplasty, including initial incisions, creation of the clitoris, creation of the labia majora and minora, and reconstruction of the vulva. This article focuses on considerations to maximize vulvar aesthetics—as such, this article will not address the varieties of techniques for vaginal canal creation. The details described herein will discuss surgical techniques used in vaginoplasty, and how technical considerations can yield different and individualized aesthetic and functional outcomes for the patient.

History

The origins of gender-affirming surgery trace back to the early twentieth century in Western Europe, spearheaded by Dr. Magnus Hirschfeld, who established the *Institut für Sexualwissenschaft* (Institute for Sexual Science) in 1919 in Berlin. It was at this clinic that the first recorded gender-affirming vaginoplasty was performed on Dora Richter.[12] But surgical techniques date even earlier in history for the management of cisgender patients with Mayer-Rokitansky-Küster-Hauser syndrome (also known as Müllerian agenesis). In 1872, Dr. C.L. Heppner described the use of skin flaps from the thigh (proximal) and rectovesical septum flaps (distal) to line a newly dissected neo-vaginal canal in a cisgender woman, conceptually paving the way for later PIV.[13] Additionally, Dr. C.L. Heppner utilized donor skin flaps from the labia, perineum, and buttocks. Similarly, Fogh-Anderson innovated using a full-thickness skin graft harvested from the penectomy specimen to create the neo-vaginal canal.[12] Building upon these early efforts, significant advancements in vaginoplasty techniques emerged.

In the 1950s, Dr. Georges Burou in Casablanca, Morocco, revolutionized the field with the development of the modern PIV technique.[14] Burou's method involved using a pedicled flap from the penile skin to construct the neo-vaginal canal. This approach offered several advantages, including a well-vascularized, durable tissue flap with minimal hair growth, making it a superior option. Burou's technique quickly gained recognition as the gold standard in gender-affirming vaginoplasty.[15] Despite continued innovation in the vaginoplasty technique, the fundamental principles of PIV, as established by Burou, remain central to contemporary surgical practices. The techniques and refinements discussed in this article build on these principles, ensuring optimal aesthetic and functional outcomes for patients undergoing this procedure.

The vaginoplasty technique continues to advance, driven by pioneering contributions from institutions such as Ghent University Hospital and the University of Gothenburg, among others.[16-18] In the following discussion, we present our surgical technique and key considerations, building upon the other approaches that have been described in the literature.

SURGICAL TECHNIQUE

Background

There are many techniques that have been described to improve aesthetic outcomes, and the merits of one over any other are up to the individual surgeon's preference. We use a variation of an approach popularized by Dr. George Burou and refined by Drs. Stanley Biber and Marci Bowers which involves the removal of the scrotal skin to be used as a graft for vaginal deepening. With this technique, the majority of the vulva and vaginal vestibule are created using phallic skin flap and urethral mucosal flap. We typically operate with the patient placed in a dorsal lithotomy position permitting easy access to the scrotum and perineum. We make midline and equal lateral marks with a marking pen before starting to establish symmetry – maintaining this symmetry through the surgery is critical.

There is a great variety in the appearance of cisgender vaginas, and similarly, there is and should be variety in vaginal appearance in transgender women.[19] As such, there is no single standard for vulvar aesthetic appearance, and the surgeon's approach should be highly individualized to patient preferences. In our office, we show prior vulvar aesthetic results to patients to assess their preferences. While not promising any results, a clear understanding of the patient's preferences pre-operatively provides us with a surgical aesthetic goal to aim for.

Incisions

When beginning the vaginoplasty, the incisions at the start of the case lay the foundation for the final aesthetic and functional outcomes of the neo-vagina. Patients' anatomy may not be symmetric, but these variations should be incorporated, and incisions should be made as symmetric as possible. These incisions determine the anterior-posterior

distance, width, height, three-dimensional contours, and robustness of the labia majora after the inversion of the penile skin. These markings will vary depending not only on the patient's aesthetic desires but also on obesity, penile size, presence of foreskin/phimosis, scrotal size, and presence/absence of fat. Figure 1 illustrates the general schematic framework for planning the vaginoplasty, with detailed descriptions of each incision provided in subsequent sections.

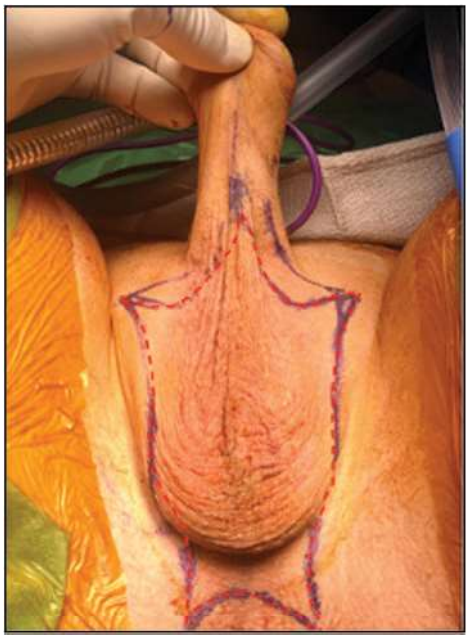

Figure 1: Initial markings setting up the incisions of the case (photo courtesy of Dr. Rajveer Purohit)

Superior incision

When making the superior incision during vaginoplasty, two considerations must be addressed. The first is the exclusion of scrotal skin. Due to individual anatomy, variations in penoscrotal webbing, and high-riding scrotal tissue, patients may have scrotal skin that extends superiorly beyond the base of the penis partway up the shaft of the penis. Semi-lunar curved superior incisions that meet at a point on the penile shaft above the insertion of scrotal skin should, as much as possible, aim to excise the rugated scrotal tissue. The height of this point is determined by how much scrotal skin needs to be excluded. If too much scrotal skin is included, this can lead to overly rugated or excessive scrotal skin on the labia majora. Figure 2A shows the skin at the penoscrotal junction that translates to the development of the labia majora. Figure 2B illustrates how failure to completely excise scrotal skin creates overly rugated labia.

The second consideration when making your superior incision is tension on the perineal body. If the incision is made higher up on the penis, there will be more tension on the posterior vaginal introitus at the perineal body, increasing the risk of posterior dehiscence. If the incision is made lower on the penile shaft, there will be more laxity and less tension on the posterior introitus. Less tension will lead to excessive skin on the labia majora and redundancy, which may be desired depending on the patient's preference.

Lateral

The lateral incisions help in determining the width of the vulva as well as the height, volume, and rugae of the labial tissue. Figure 3 illustrates the impact of

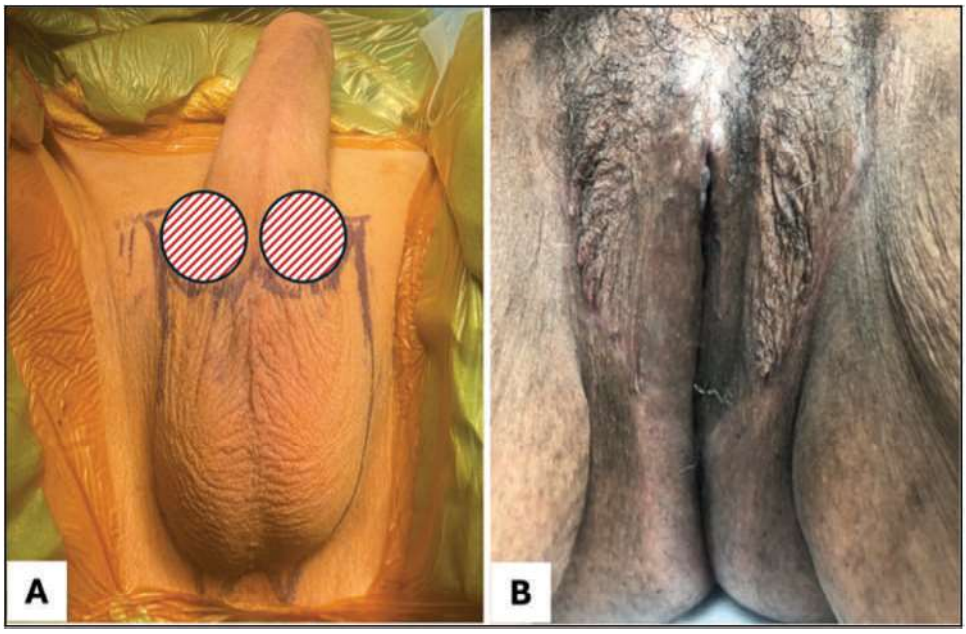

Figure 2: Elongation of penoscrotal skin when creating labia majora during the penile inversion. (a) superior incision (marked with red lines) transposed to form the labia majora. (b) overly rugated labia majora when scrotal skin is included superiorly (photo courtesy of Dr. Rajveer Purohit)

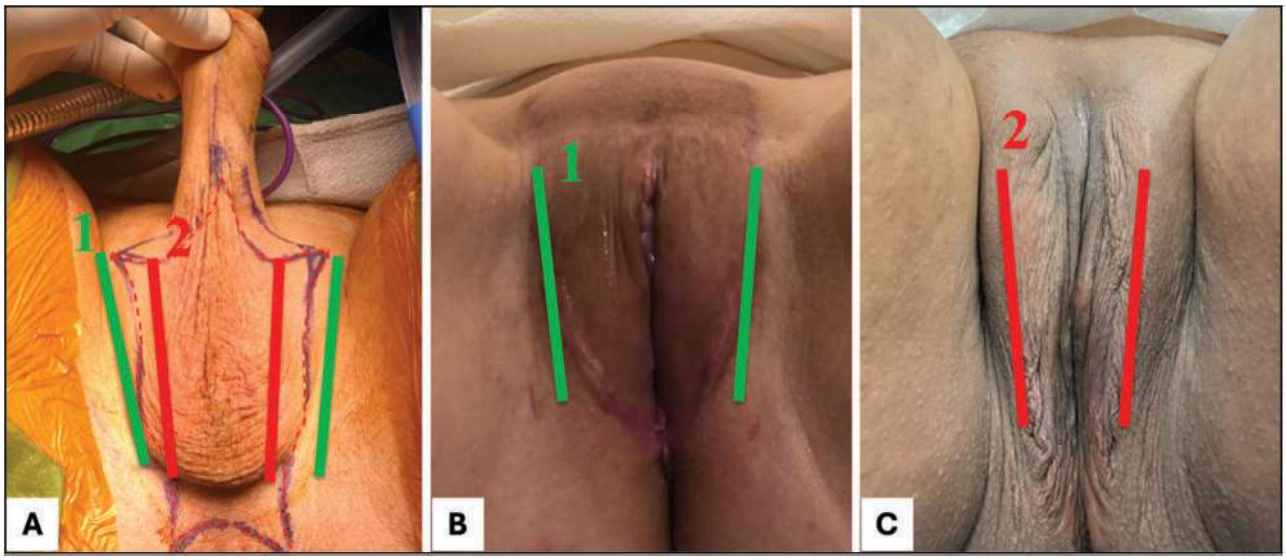

Figure 3: Effect of laterality of the incisions on the height and width of the vulva and introitus after penile inversion (photo courtesy of Dr. Rajveer Purohit)

incision placement on these outcomes. A wider lateral incision often leads to a flatter and wider vulva with less prominent labia majora. This occurs, in part, because the wider incision excises more inguinal skin, leaving a larger surface area requiring coverage with the transposed penoscrotal skin. As the scrotal fat, tunica vaginalis, and penoscrotal skin are distributed across the wider defect between the vaginal canal and inguinal crease, the labia majora appear flatter and less defined. The advantage of the more lateral incision is that it can be better hidden in the inguinal crease. The green lines in Figure 3 show how this broader distribution leads to a flatter final contour of the labia majora.

Conversely, a narrower initial incision leads to a more defined three-dimensional contour of the labia majora. This is because a narrower incision leaves more of the native inguinal skin intact. This preserved skin creates a smaller surface area for the transposed scrotal fat, tunica vaginalis, and labial skin to cover, resulting in a more voluminous and well-defined labia majora with enhanced three-dimensionality. The red incisions in Figure 3 show how the incorporation of more native inguinal skin creates a more pronounced three-dimensional contour and definition of the labia majora.

Posterior

The posterior incision influences the width of the perineal body and the overall shaping of the vulva. A wide inverted U-shaped posterior incision provides a wider vascularized advancement flap for anastomosis to the phallic skin to create the posterior vaginal introitus. This area is the source of breakdown post-operatively, and local ischemia of both the phallic skin and the perineal flap may be a significant contributor to this risk. The wider flap, however, leaves a wider-appearing introitus, displacing the posterior labia majora laterally, and significantly altering the overall appearance of the vulva. A narrower posterior U flap or none at all may increase the risk of post-operative ischemia at the site and bring the posterior labia majora more medially, leading to a more ellipsoid shape of the vulva. This comparison is illustrated in the red bar in Figure 4. A narrower perineal body also helps to conceal the introitus of the neo-vagina by bringing the labia majora together to a narrow point.

The second consideration for the posterior incision marking includes the size of the perineal body. The average length of the perineal body in cisgender individuals is very short.[20] Figure 4 also demonstrates the different aesthetic outcomes when creating a longer perineal body [Figure 4A] and a shorter perineal body [Figure 4B]. In addition, the longer the perineal distance, in our experience, the greater the chances of a high-riding posterior introital ridge. This can make penetrative intercourse more difficult and may require secondary revision introitoplasty. However, creating a short perineal body may need to be avoided in patients who have a dearth of phallic skin from aggressive circumcision, genital hypoplasia, or an absence of laxity in the genital skin. When inverting the phallic skin, bringing the posterior phallic skin flap to the posterior introitus without significant tension can be difficult. In these situations, it is better to decrease the tension on the posterior introitus by bringing the posterior incision more anterior (higher), resulting in a larger posterior ridge. Doing this decreases the risk of posterior wound dehiscence; if deemed necessary, an introitoplasty can be performed at a later stage.

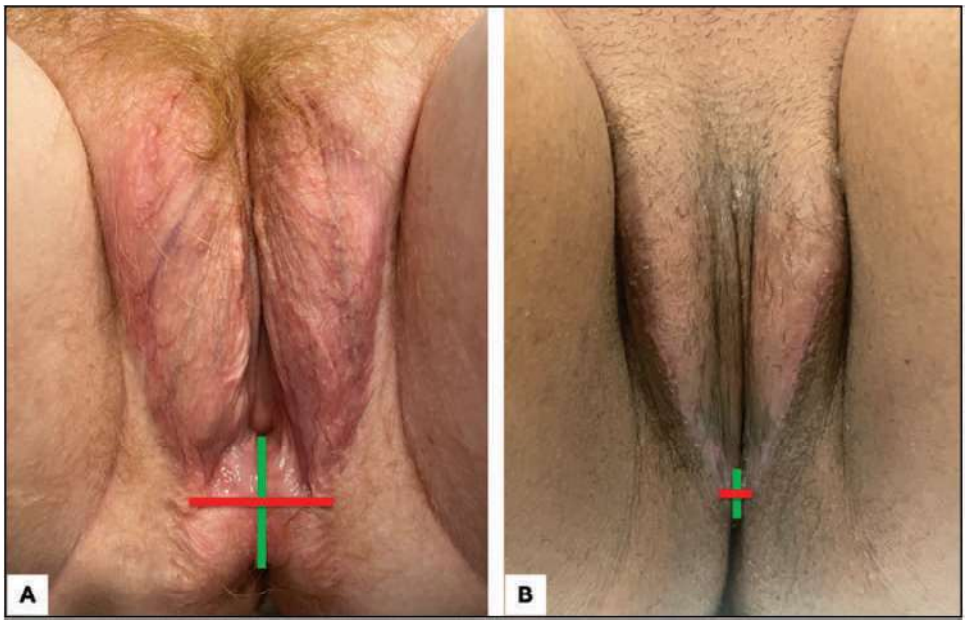

Figure 4: (a) wide perineal body vs. (b) narrow perineal body depending on width of the initial incision (photo courtesy of Dr. Rajveer Purohit)

CLITORIS AND THE NEUROVASCULAR PEDICLE

Considerations

The clitoris created during a vaginoplasty originates from the glans of the penis.[21] A variety of techniques have been described, all of which preserve the ability to achieve orgasm.[22] A key principle in all these techniques is the meticulous preservation of the neurovascular bundle on the dorsal aspect of the penis. Distally, these nerves fan out on the dorsal surface of the glans, clustering both superficially and deeply near the corona with less density of sensory nerves toward the glans tip.[23] The glans size needs to be reduced to make it appropriately sized for a clitoris. This can be done by surgically excising and de-epithelializing parts of the glans to decrease their surface area. The distal/ventral glans tissue is the best location to be excised due to the neural anatomy. Excision of the distal segment also prevents any residual meatal or urethral tissue recurrence. This principle, if performed correctly, will allow for both stimulation and orgasmic function.[24] If insufficient glans tissue is excised, clitoromegaly can occur which can be painful and bothersome to the patient. Figure 5 illustrates clitoromegaly due to the majority of the glans, including the distal meatus, being preserved during the vaginoplasty. Since the glans tissue is composed of corpus spongiosum, it engorges during stimulation, which can exacerbate enlargement and discomfort.

Figure 5: Excessive glans preservation for neo-clitoris (photo courtesy of Dr. Rajveer Purohit, results from a different surgeon)

Dissection of the neurovascular bundle

There are two common techniques to isolate the neurovascular pedicle. One involves lateral incisions into the corporal cavernosa, leaving the dorsal tunica of the corpora cavernosa attached to the neurovascular pedicle. Residual erectile corporal tissue on the ventral portion of the tunica remnant is then removed, as patients may complain of pain and swelling with arousal post-operatively.[16] This technique permits a quicker dissection of the neurovascular bundle but can leave a bulky remnant superior to the clitoris, which can be prominent in low body mass index patients. Although it typically takes longer to perform, an alternative we prefer is to dissect the neurovascular bundle completely free from the corpora cavernosa by incising Buck's fascia just dorsal

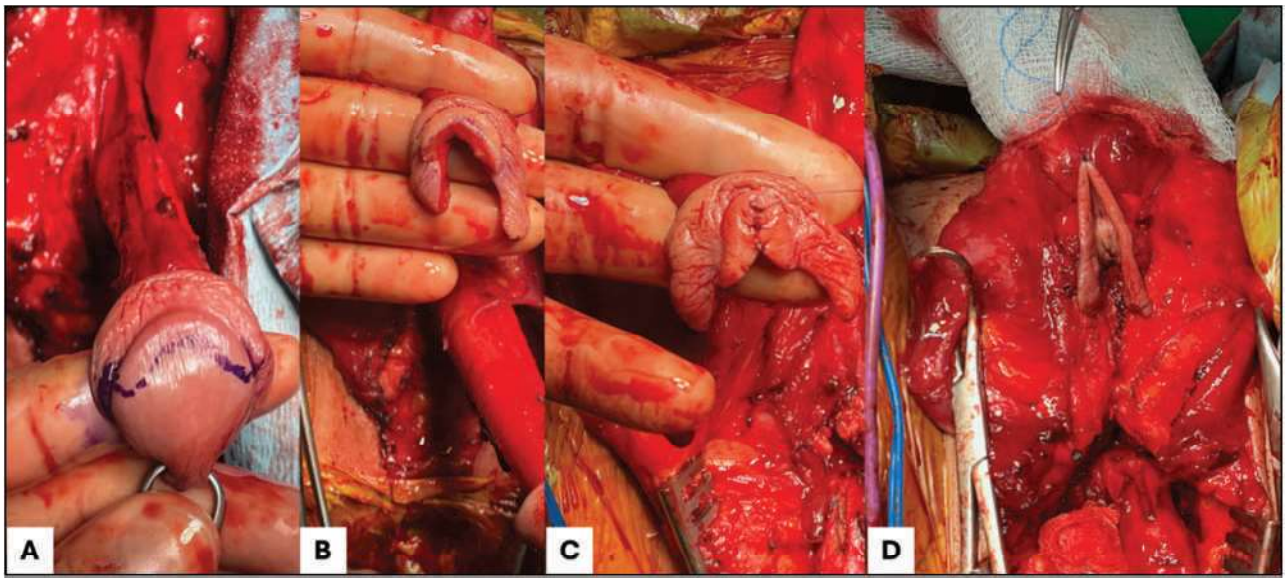

Figure 6: W-shaped marking for the incision (a). Excised glans tissue for clitoral harvesting on its neurovascular pedicle (b). Reconstructed clitoris (c). Inner preputial skin for creation of clitoral hooding and labia minora (d) (photo courtesy of Dr. Rajveer Purohit)

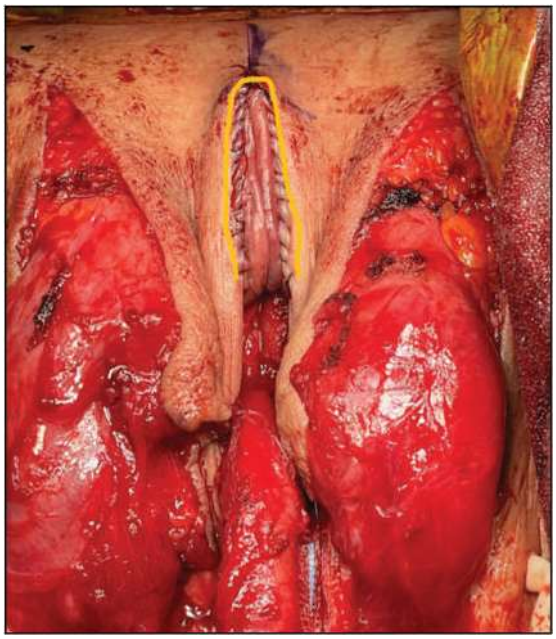

Figure 7: Labia minora creation extending from the clitoral hood. The suture line between the urethral window and inverted penile skin is marked in yellow (photo courtesy of Dr. Rajveer Purohit)

to the urethra, separating the pedicle completely from the underlying corpora cavernosa, which permits the removal of the corporal bodies in their entirety. This avoids a bulky bundle above the clitoris or in the vestibule.

After the neurovascular bundle is free, we excise the ventral and distal aspects of the glans, including the urethral meatus, preserving the dorsal and proximal glans tissue. A portion of this becomes the clitoris and a portion the beginnings of the inner labia. This method improves cosmesis while preserving sensation and sexual function. Figures 6 and 7 demonstrate the incisions used to reconstruct the clitoris from the glans. The incision is made along the coronal sulcus of the glans, with the remaining glans tissue excised.

Additionally, a rim of inner preputial skin from the penile shaft skin is preserved. Pre-operative discussion with the patient regarding the size of the labia they prefer directs the size of the preputial remnant, that is, preserved. Typically about 1 cm of inner preputial skin is preserved. More skin should be preserved initially, as excess skin can later be trimmed as needed.

Reconstruction

Once the coronal sulcus, preputial skin, and neurovascular bundle have been isolated and preserved, the clitoris is formed by suturing the medial aspect of the glans tissue together, creating the clitoris. Monofilament absorbable interrupted sutures can be used to approximate the edges of tissue, creating an ovoid-shaped clitoris. Once sutured, the preputial skin will begin to serve as the clitoral hood. Figure 6 demonstrates how the clitoris is sutured together with adequate coverage of the preputial skin. The preputial skin remnant is rolled over the clitoris which drapes over to create the hood and allows the rudimentary labia minora to take shape.

LABIA MINORA

The medial labia minora is created from the inner preputial skin margin that remains attached to the coronal

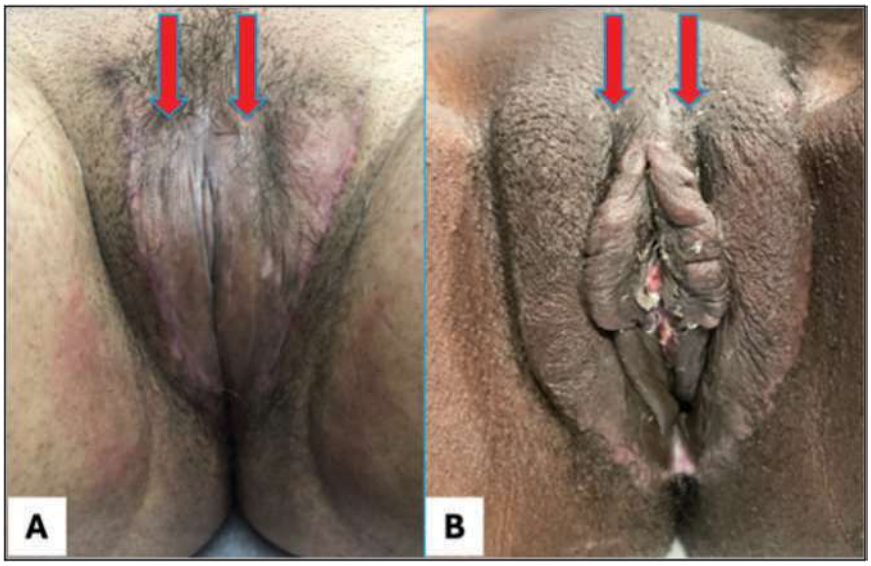

Figure 8: Comparison of a less defined (a) vs. well-defined medial sulcus (b) (photo courtesy of Dr. Rajveer Purohit)

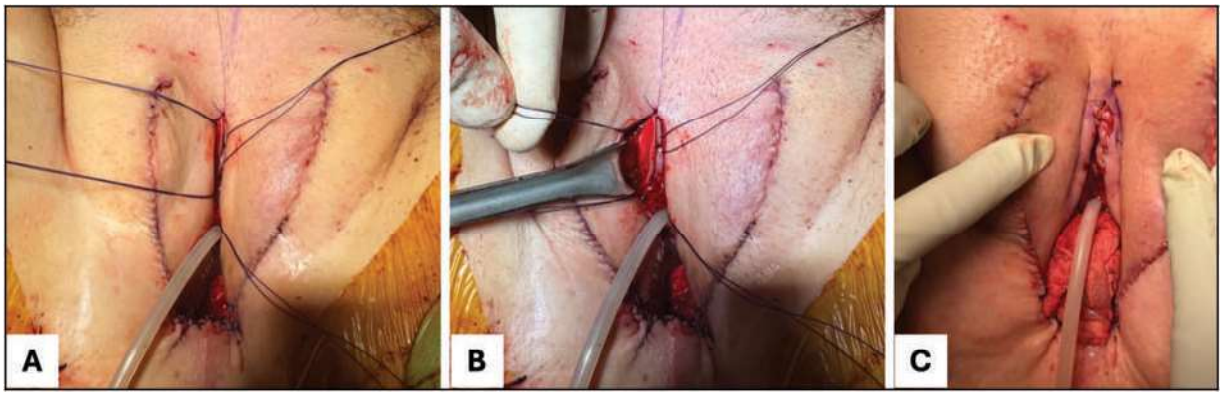

Figure 9: Medial labial sulcus creation. Placement of four retention sutures (a) adjacent to the cut edge of the phallic skin flap. (b) Sutures anchoring into deeper fat or periosteum of the pubic bone. (c) Final result showing defined labia minora (photo courtesy of Dr. Rajveer Purohit)

sulcus.[6] The preputial skin drapes over the neo-clitoris, creating the hood, and then extends posterolateral to the introitus. The draping of the preputial skin beyond the clitoris lateral to the introitus creates the labia minora. This draped skin is sutured to the edges of the inverted penile skin and the urethral mucosal advancement flap which secures the labia minora in place.

MEDIAL LABIAL SULCUS

The medial labial sulcus critically defines the labia minora and labia majora. Without additional steps following the initial suturing of the labia minora, the tissue may flatten over time, resulting in a loss of definition. Figure 8 highlights the difference in labial definition in two cases where the medial sulcus was created vs. where it was not.

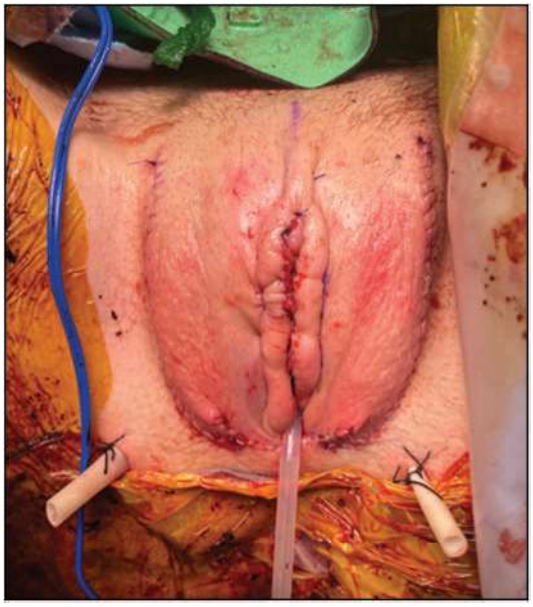

Figure 10: Trans-epithelial "bunching" sutures to define the labia minora (photo courtesy of Dr. Rajveer Purohit)

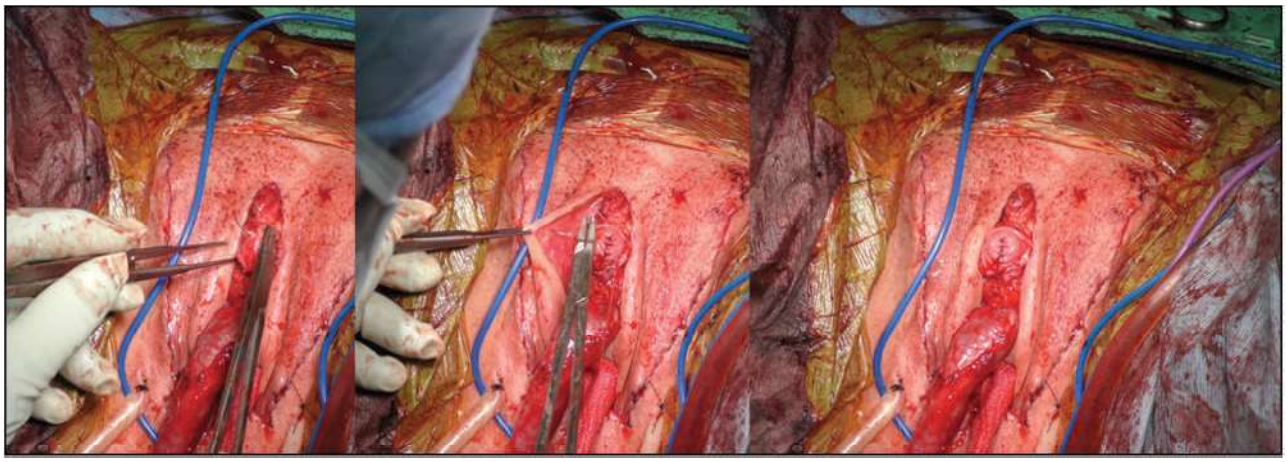

Figure 11: Sub-epithelial "bunching" sutures to define the labia minora (photo courtesy of Dr. Rajveer Purohit)

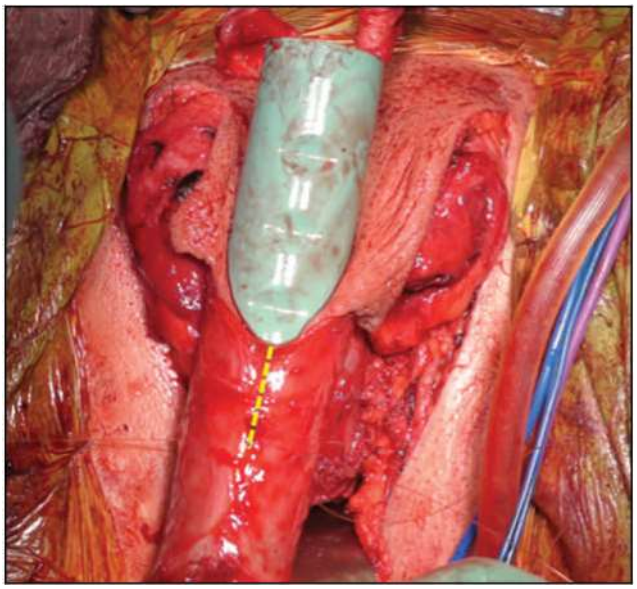

Figure 12: Creation of neo-vaginal introitus during inversion of penile skin. An incision can be made along the yellow dotted line to increase the circumference of the introitus if additional distance needs to be covered to reach the perineal body (photo courtesy of Dr. Rajveer Purohit)

We create the medial sulcus by placing multiple braided absorbable retention sutures adjacent to the cut edge of the phallic skin flap at the vaginal vestibule and anchor these into deeper fat or periosteum of the pubic bone. These sutures help delineate the junction between the labia minora and labia majora and also better define the labia minora [Figure 9].

To further define the labia minora, trans-epithelial sutures are placed by some surgeons in a horizontal mattress pattern through the sutured labia minora to "bunch" the tissue together. However, in our experience, the effect of these sutures often fades over time and the labia flatten out [Figure 10]. For this reason, we have generally minimized using this technique. An alternative is sub-epithelial sutures that can be placed for further delineation of the labia minora [Figure 11]. Both techniques aim to enhance the definition of the labia minora. If there is inadequate length to the preputial skin to extend all the way down to the posterior edge of the vault for the creation of the labia minora, these sutures can help to further augment, extend, and define the labia minora.

POSTERIOR FOURCHETTE

The posterior fourchette represents the most posterior portion of the introitus in the neo-vagina. It is created by suturing the margin of the superior incision to the posterior perineal body incision. The posterior fourchette is determined by three factors. The first two were previously described – the superior and posterior initial incisions when beginning the vaginoplasty. The last factor is the circumference of the neo-vaginal opening. The circumference of the neo-vaginal opening is first determined by the initial circumference and location of the inverted phallic skin flap. However, this circumference can be expanded by medially incising the ventral portion of the penile shaft skin. This can be more clearly identified by placing a vaginal dilator into the inverted penile skin to see how the introitus of the neo-vaginal canal aligns with the initial incisions made at the start of the case. Figure 12 demonstrates how the neo-vaginal canal can be visualized with a dilator. A possible incision is marked with the yellow dotted line, where an incision can be made to allow the posterior fourchette to be anastomosed in a tension-free manner and increase the circumference of the neo-vaginal introitus. We incise this sharply to avoid ischemia of tissue from monopolar cautery, which may increase the risk of posterior wall dehiscence.

The three factors described above ultimately will inform the height of the perineal body and the location of the

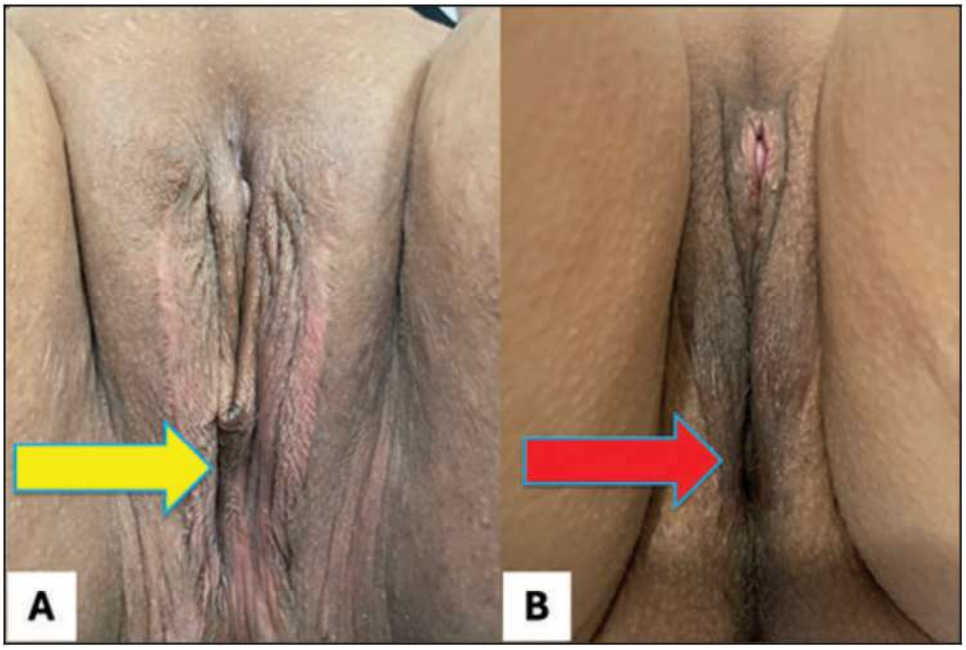

Figure 13: Larger perineal body (a) vs. smaller perineal body (b). Left image has redundant tissue on the posterior fourchette which interferes with function (photo courtesy of Dr. Rajveer Purohit)

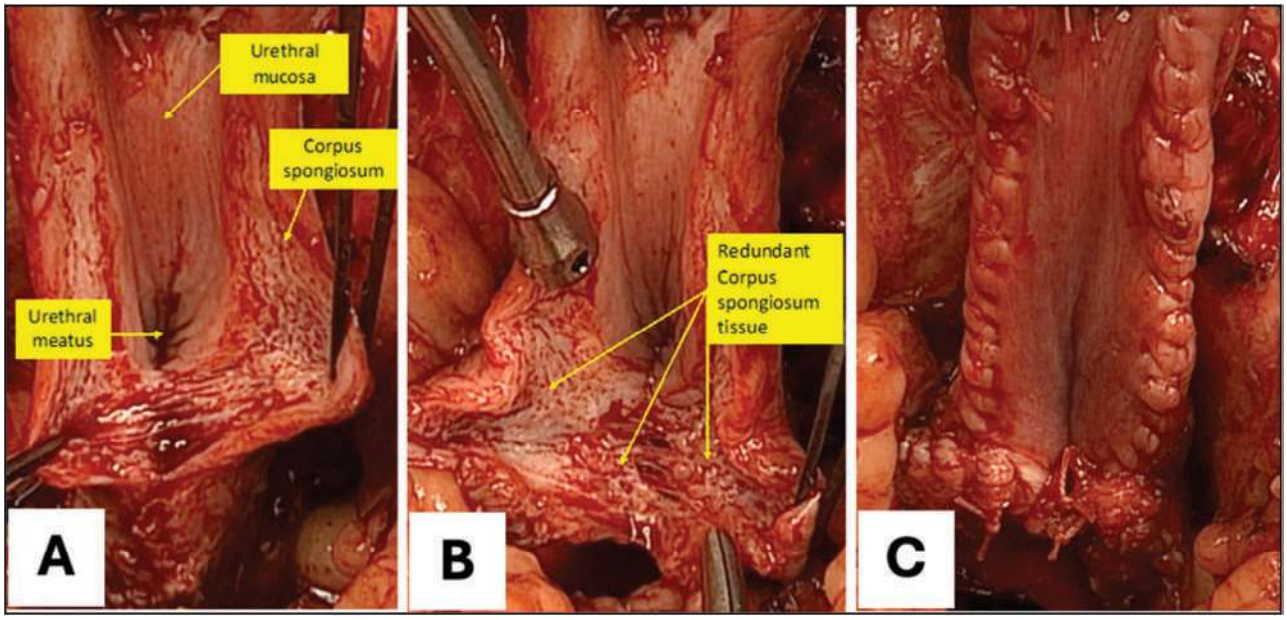

Figure 14: Proximal dissection of urethra after ventral spatulation (a) showing redundant spongiosum tissue (b). Final result after resection of redundant bulbar spongiosum tissue (c) (photo courtesy of Dr. Rajveer Purohit)

neo-vaginal introitus. A smaller perineal body and larger introitus lead to less redundant skin and a more direct trajectory into the neo-vaginal canal. Conversely, if the perineal body is larger, it can create a slight angle or lip of redundant tissue which can interfere with direct access into the neo-vaginal canal during dilations or sexual activity. Figure 13 shows a case where the perineal body is larger due to a more anterior location of the posterior fourchette (left) and a case with a smaller perineal body leading to a more posterior location of the posterior fourchette (right).

URETHRAL PLATE

A key consideration when creating the new vaginal vestibule with urethra is the volume of spongiosum tissue used. Similar to the glans in clitoral construction, the urethra is

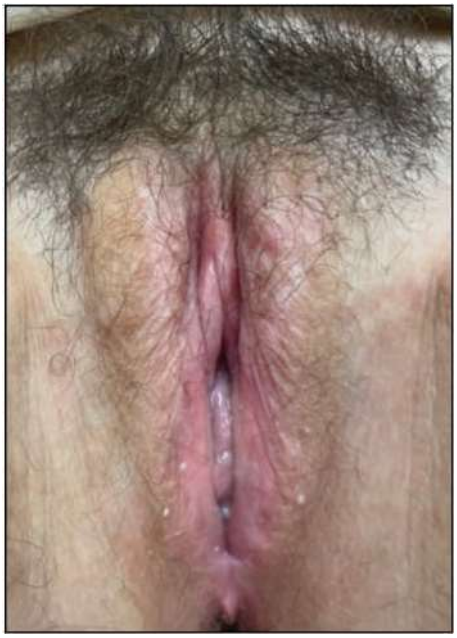

Figure 15: One-year post-operative physical exam showing good aesthetic results of vulva

also composed of spongiosum, which can engorge with blood, especially during arousal.[7,24] This engorgement can be painful, bothersome, and interfere with permitting penetrative intercourse. When creating the urethral mucosal flap and creating the urethral plate, excess corpus spongiosum must be excised to prevent future dilation of the urethral sponge, which can compromise both functional and cosmetic outcomes of the vaginal vestibule and introitus [Figures 14 and 15].

CONCLUSION

There is no universally accepted cosmetically "ideal vagina" in transgender women undergoing vaginoplasty. It is critical to discuss with patients pre-operatively what their functional and aesthetic wishes are and plan surgery accordingly. Technical considerations and steps taken during the surgery can help achieve the patient's goal. This begins with how the incisions are made, including the superior, lateral, and posterior extent of the incisions. Refinement in the construction of the clitoris, labia minora, and medial sulcus further develops the aesthetic outcome. Maintaining symmetry from the incision to the final suture is critical for aesthetic outcomes. Taken together, these technical considerations can greatly influence the aesthetics and function of the vaginoplasty. Understanding variations in these techniques and their overall impact on the final appearance is essential for tailoring the surgery to each patient's needs. Patients should be informed of the available options, allowing for a personalized approach to vaginoplasty in transgender women.

Author's contributions

- CT: Writing (original draft, reviewing/editing).
- RP: Conceptualization, supervision.

Ethical approval

Ethical approval is not required for this review given that no human study/data was analyzed.

Limitations

This review presents a single surgeon's results and experience.

Consent

Written informed consent was obtained for anonymized patient information to be published in this article.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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