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Metoidioplasty: techniques and outcomes

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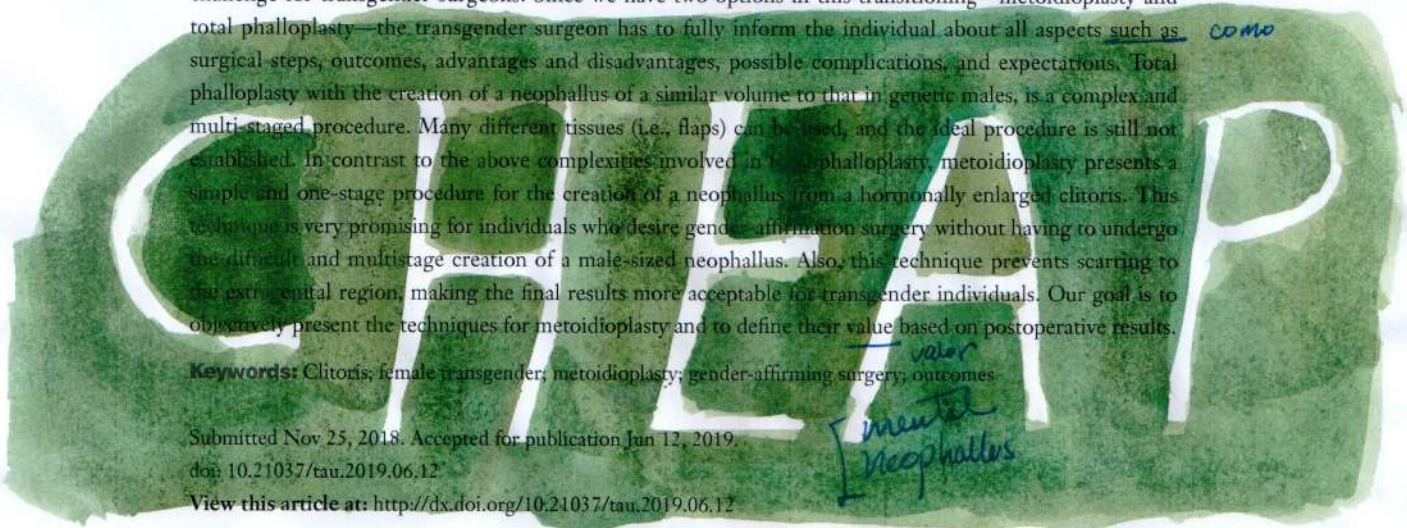
Abstract: Phalloplasty represents the latest step in female-to-male transitioning and still remains a great challenge for transgender surgeons. Since we have two options in this transitioning—metoidioplasty and total phalloplasty—the transgender surgeon has to fully inform the individual about all aspects such as surgical steps, outcomes, advantages and disadvantages, possible complications, and expectations. Total phalloplasty with the creation of a neophallus of a similar volume to that in genetic males, is a complex and multi-staged procedure. Many different tissues (i.e., flaps) can be used, and the ideal procedure is still not established. In contrast to the above complexities involved in total phalloplasty, metoidioplasty presents a simple and one-stage procedure for the creation of a neophallus from a hormonally enlarged clitoris. This technique is very promising for individuals who desire gender-affirmation surgery without having to undergo the difficult and multistage creation of a male-sized neophallus. Also, this technique prevents scarring to the extragenital region, making the final results more acceptable for transgender individuals. Our goal is to objectively present the techniques for metoidioplasty and to define their value based on postoperative results.

Keywords: Clitoris; female transgender; metoidioplasty; gender-affirming surgery; outcomes

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Introduction

Gender-affirming surgery presents the latest development in genital transition for individuals with gender dysphoria. The World Professional Association for Transgender Health (WPATH) proposed guidelines for the treatment of transgender people. The most recent Version 8 of WPATH standards of care offers more flexible options for this treatment and defines all criteria for male-to-female and female-to-male transgenders (1,2). According to these standards, individuals are required to provide two letters of recommendation from board certified mental health providers, who should confirm gender identity and recommend further hormonal therapy according to the real-life test and “adjusting the body to the mind”. Preoperative consultation with transgender surgeons with a description of desired outcomes and possible complications should be

done to prevent postoperative disappointment.

Surgical transition in trans men includes bilateral mastectomy, removal of internal genital organs (uterus, ovaries, and fallopian tubes), vaginectomy, and phalloplasty. There are two options for the creation of male genitalia: total phalloplasty and metoidioplasty. Total phalloplasty presents one of the most demanding tasks in genital reconstructive surgery, as it requires the creation of a neophallus from extragenital tissue large enough to enable insertion of a penile prosthesis, penetration during sexual intercourse, and voiding in the standing position (3,4). Different techniques have been described for both neophallic and neourethra reconstruction. The most common reconstruction is radial free forearm flap (RFFF) phalloplasty with simultaneous urethral reconstruction with the “tube within a tube” technique (3,4). The musculocutaneous latissimus dorsi (MLD) flap is an alternative option for neophallic



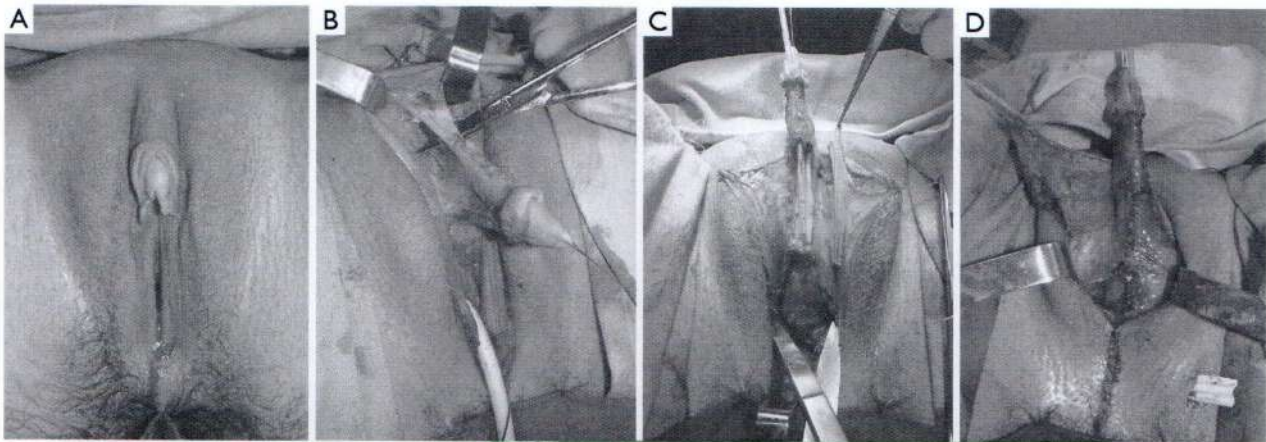


Figure 1 Belgrade metoidioplasty technique. (A) Preoperative appearance. Clitoris is hormonally enlarged. (B) Clitoral ligaments are completely divided up to the bone attachment enabling maximal lengthening of the clitoris. (C) The short urethral plate is divided, and the gap between the two parts is filled with buccal mucosa graft. A fasciocutaneous flap is harvested from the left labia minora, to be joined with the buccal mucosa graft. (D) A neourethra is formed by combining the vascularized genital flaps with the buccal mucosa graft. All suture lines are covered with well-vascularized tissue.

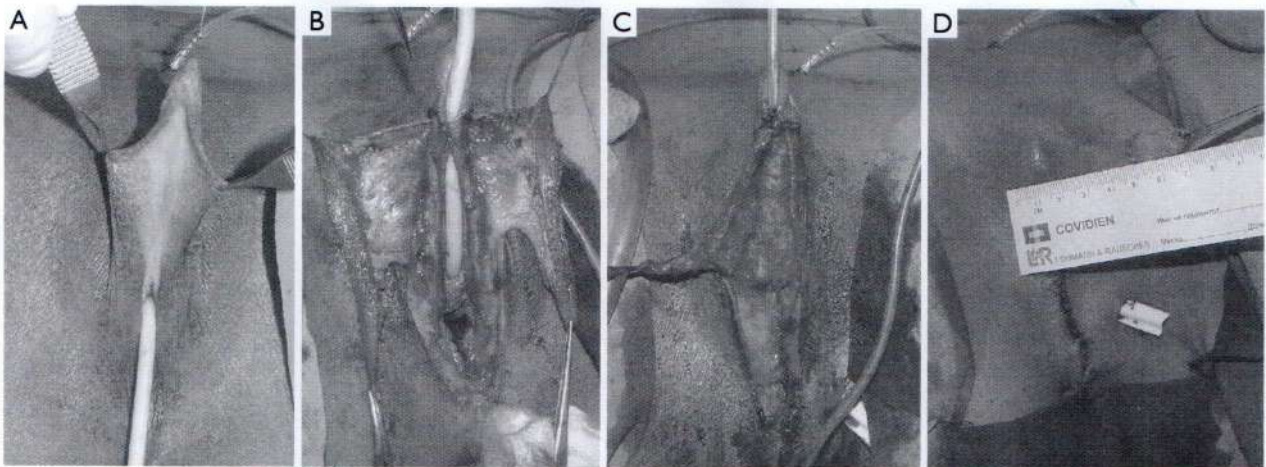
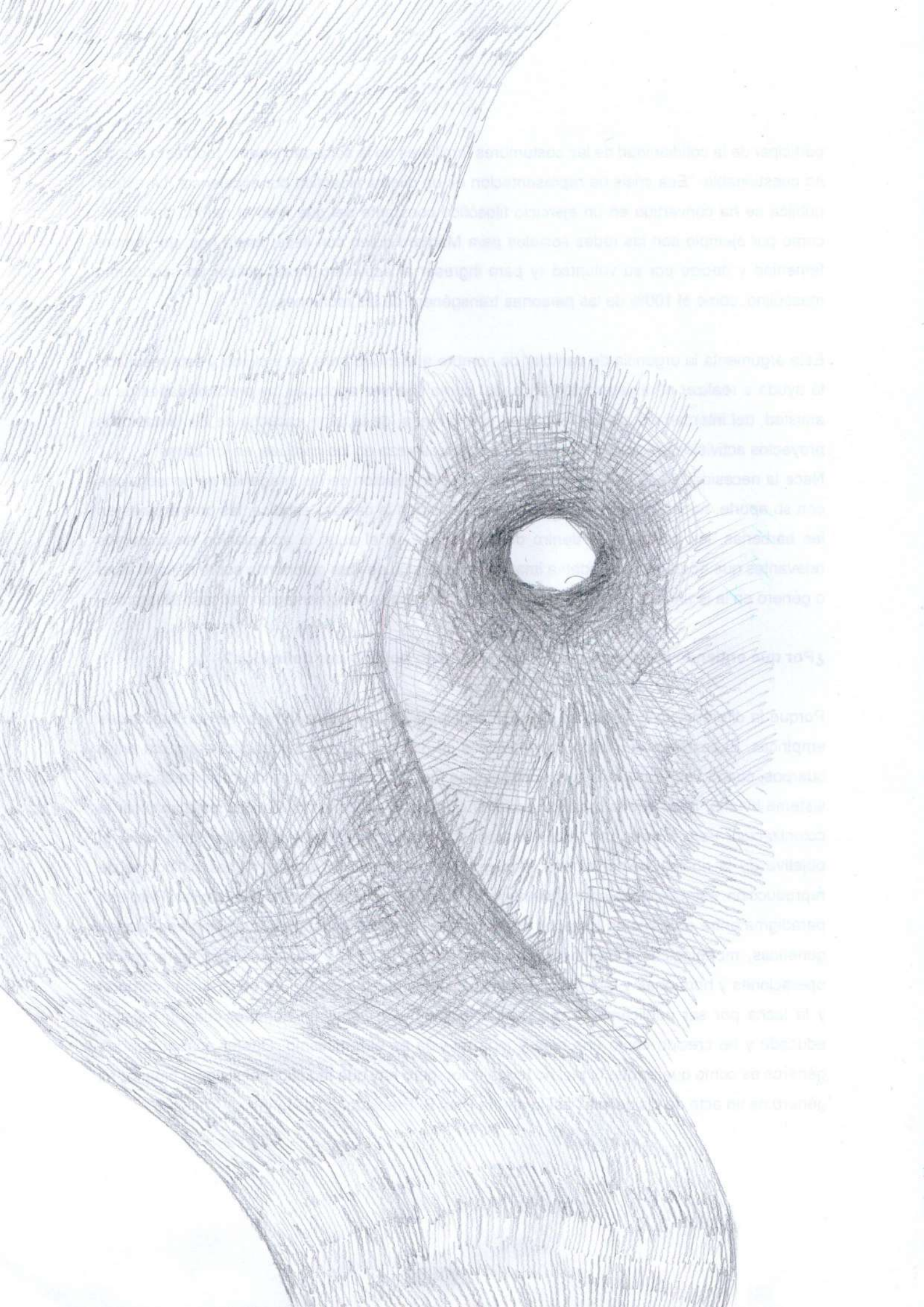


Figure 2 A case with a well-developed urethral plate (A). The urethral plate is dissected and mobilized maximally enabling easy tubularization without tension (B). Urethroplasty is complete and the neourethra is covered with surrounding tissue to prevent postoperative fistula (C). A good length of the neophallus is achieved (D).

the importance of the technique based on postoperative reports describing excellent sensation, erection, and good psychosexual features. Although the volume of the neophallus is not enough for full penetrative sexual intercourse, additional phalloplasty is always possible.

Surgical complications can be divided into minor and major categories. Minor complications are usually managed conservatively and include postoperative hematomas,

local skin infections, partial necrosis, urinary infections, and some voiding problems (dribble, spraying, etc.). Major complications include urethral strictures, urethral fistulas, and problems with testicle implants (displacement, rejection). According to literature data, urethral fistula and stricture are reported in 7–15% and 2–3% of cases, respectively. Revision surgery includes excision of fistula with appropriate covering or stricture repair either by direct



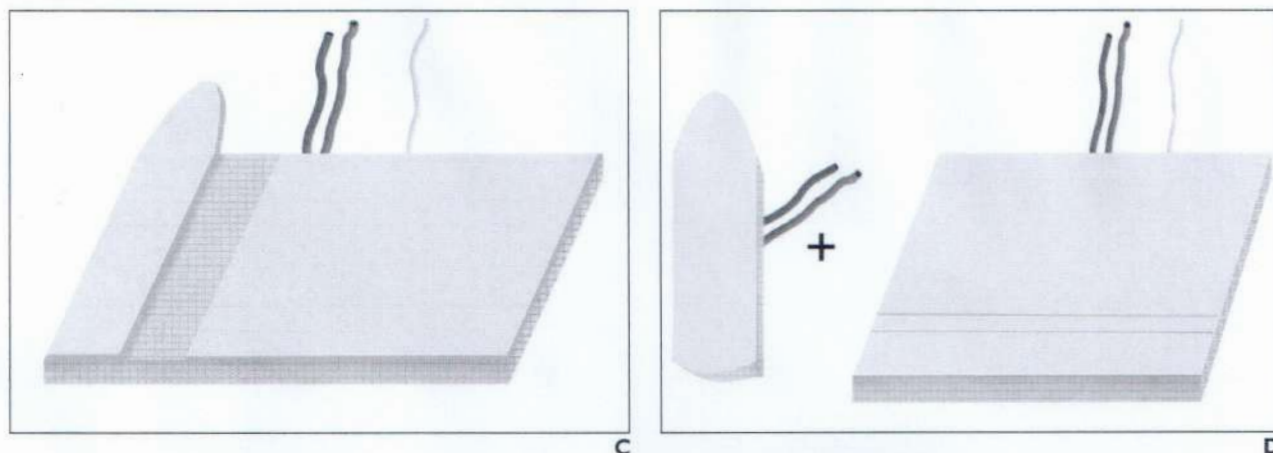


Fig. 3 (continued)—Drawings show free flap and pedicled flap designs that can be used to create phallus. Artery (red) of each flap is anastomosed with deep inferior epigastric artery, which is procedure at Oregon Health and Science University, but may also be anastomosed to femoral artery in end-to-side fashion. Vein or veins (blue) are connected to greater saphenous vein or its contributing vessels or to deep inferior epigastric vein or veins. Yellow is graphical representation of cutaneous sensory nerves that are anastomosed for neurotized flap. Reprinted from [17] with permission from Elsevier.

C. Tube-within-tube phalloplasty

D. Composite phalloplasty using two separate flaps with urethra coming from forearm flap.

important to note that not every surgeon performs or stages the procedure the same way. Thus, understanding the components of phalloplasty creation allows the radiologist to accurately identify and assess the complications occurring between surgical stages.

Shaft and Shaft Urethra

A phalloplasty can be designed and constructed using multiple donor sites, offering a variety of reconstructive options. There are no guidelines or algorithms to direct reconstructive surgeons in phalloplasty design. Rather, preoperative assessment is based on patient body habitus, concerns for donor site morbidity, and most importantly, preference regarding function of the phallus. Table 2 summarizes common donor sites for different phallic designs. In the United States, the most frequently used donor sites are the forearm and the anterolateral thigh (ALT) [18]. These donor sites can be used to construct the shaft and urethra as one complete unit using the tube-within-tube design or can be used separately to construct the neourethra independently of the shaft, which is referred to as “composite phalloplasty”; an example of composite phalloplasty is the use of an ulnar forearm flap for urethral construction and an ALT flap for shaft construction (Fig. 3).

Patients may decide that they want to forgo the urethral component and just receive a shaft. In this case, either the native genital anatomy can remain unaltered or a scrotoplasty can be performed and the vaginal canal and urethra remain in their native po-

sition. Some patients may opt to also undergo a vaginectomy and perineal closure with a permanent perineal urostomy.

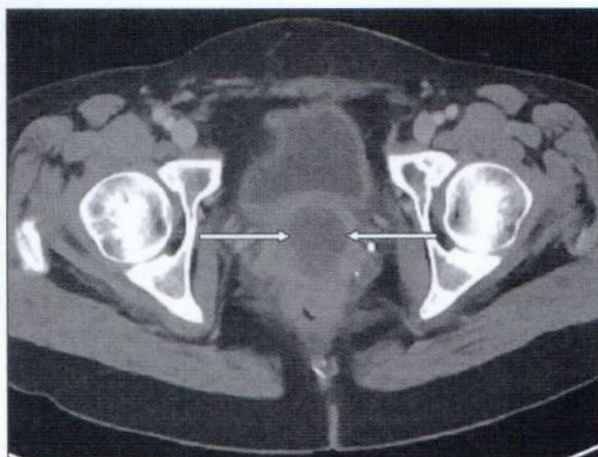
Perineal Masculinization

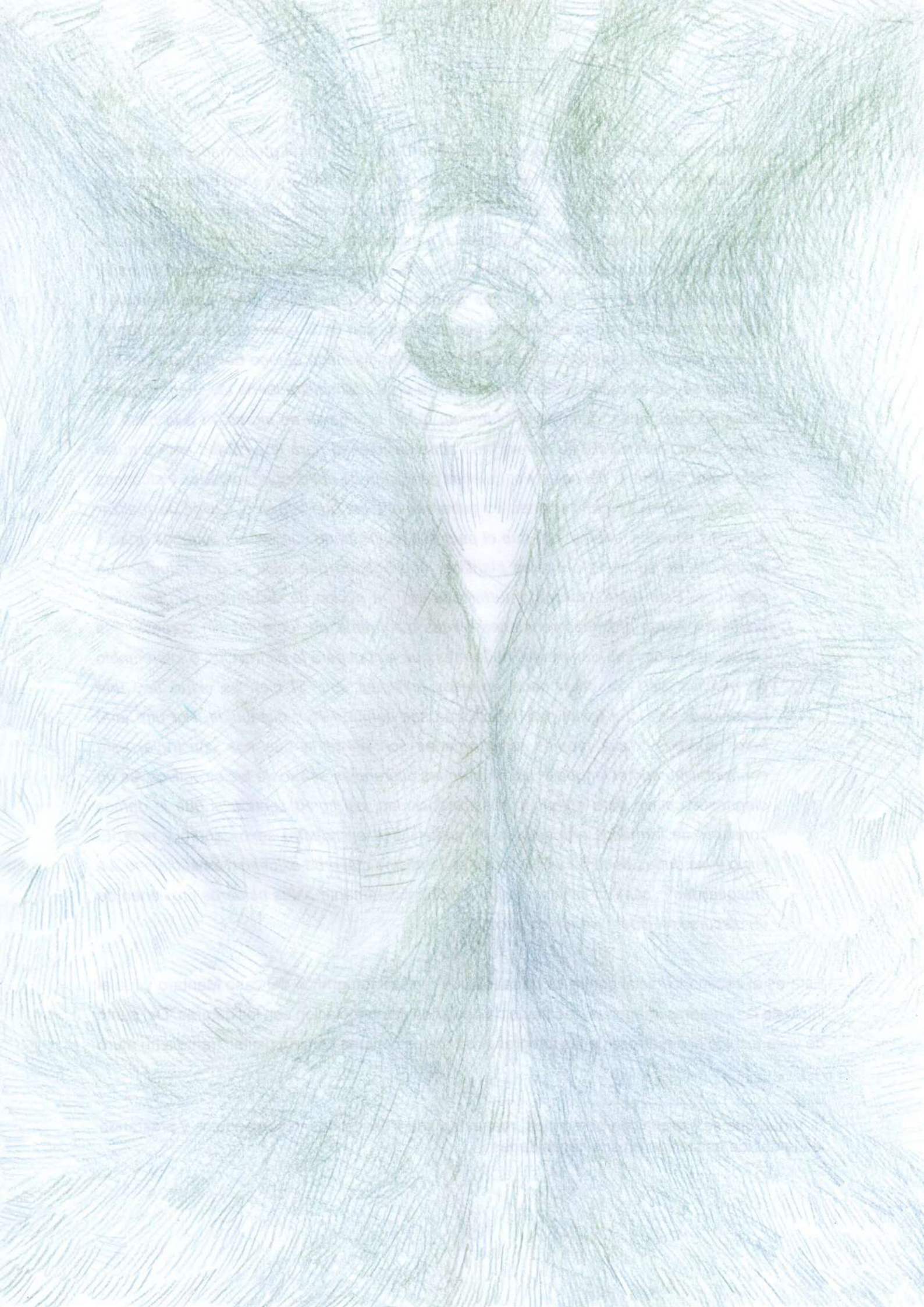
During perineal masculinization, a vaginectomy is performed concurrently with or after hysterectomy. Care is taken to not violate the rectum posteriorly and the bladder anteriorly. Patients with previous abdominal surgeries, including hysterectomy, may also have abdominal adhesions and overdissection, especially in the apex, may create adherent bowel. Once the vaginal mucosal lining is excised, if the peritoneum was entered, it is closed. The paravaginal space is obliterated typically with purse-string sutures starting at the vaginal apex. This involves the approximation of the pubocervical

fascia anteriorly to the prerectal fascia posteriorly with incorporation of the pelvic sidewalls and bulbocavernosus muscles and the pelvic levator muscles laterally. To close the genital hiatus, the levator muscles are tightly plicated [20]. Some surgeons only perform an ablatative procedure with electrocautery to create a third-degree burn. In those cases, there is a theoretic higher risk for retention of vaginal mucosa and a higher risk for mucosal neoplasia (Fig. 4).

Final closure of the perineal skin is completed after the urethra-lengthening procedure. The perineal urethra (pars fixa) is created using tissue from the urethral plate, anterior vaginal wall, and vulva. There are a variety of ways of performing this procedure with the same end result of a vascularized neourethra that is sutured superiorly to the

Fig. 4—Late-20-year-old trans-masculine patient after first-stage phalloplasty presented with perineal pain and fullness approximately 120 days after undergoing vaginectomy with urethroplasty and perineorraphy for masculinization of perineum. Axial contrast-enhanced CT image of pelvis shows thick-walled, fluid-density collection (arrows) between bladder and rectum with surrounding fat stranding, representing pathologically proven mucocele. Abscess could have similar appearance in appropriate clinical setting.





preserving the excellent vascularization of the flap. The pedicle was additionally mobilized and lengthened from the adjacent subcutaneous tissue to enable suturing with buccal mucosa without tension. Labia minora flap was joined to the buccal mucosa graft by two lateral running sutures (Figures 1F and 3B). Urethra was calibrated prior to closure to no less than 16 Fr in diameter.

A 14-Fr silicone tube with multiple perforations was inserted into the new urethra as a small-caliber stent to be used for buccal mucosa moisturizing and to maintain urethral lumen. When developed, the glans wings were approximated ventrally, creating neomeatus. Penile skin reconstruction was performed using the remaining clitoral and labia minora skin flaps (Figure 4A).

A male-like perineum was created by closure of the vaginal space. Both labia majora were joined in midline to create the scrotum. Silicone testicular prostheses were inserted through the bilateral incisions placed at the top of labia majora, finalizing scrotoplasty. Suprapubic urine tube was placed for gravity drainage for 3 weeks. The urethral stent was removed 7 days after surgery. Broad-spectrum antibiotics and oxybutynin were given to prevent postoperative infection and bladder overactivity, respectively. Use of a vacuum device was recommended to all patients for a period of 6 months, starting 4 weeks following surgery, to prevent postoperative adhesions and subsequent shortening of the neophallus.

Results were statistically analyzed using the Z-test to evaluate the difference between the two approaches with the significance level of 0.05. In addition, a postoperative questionnaire was used, which included questions about functioning and esthetical appearance of participating subjects. Patients were asked about voiding while standing, the quality of erection and sensations of the neophallus, and overall satisfaction with appearance of new genitalia and measured on a three-point scale (1—dissatisfied, 2—somewhat satisfied, and 3—completely satisfied).

Results

The follow-up ranged from 12 to 118 months (median 39 months). The technique with buccal mucosa graft and clitoral skin flap (group I) was performed in 49 and the other technique, using buccal mucosa graft and labial skin flap (group II), in 158 patients. Median operative time was 226 minutes (range 189–296 minutes) in the first and 233 minutes (range 176–288 minutes) in

the second group. The mean estimated blood loss was 168 mL (ranging from 127 to 274 mL) and none of the patients required blood transfusion. All included patients were evaluated at 3, 6, and 12 months postoperatively. Last appointment included a questionnaire about functioning and esthetical appearance of the new male genitalia.

Adequate urethral diameter was confirmed in all patients by urethrography and uroflowmetry. During the follow-up period, the postoperative urinary flow rate was >15 mL/second (mean 15.4)

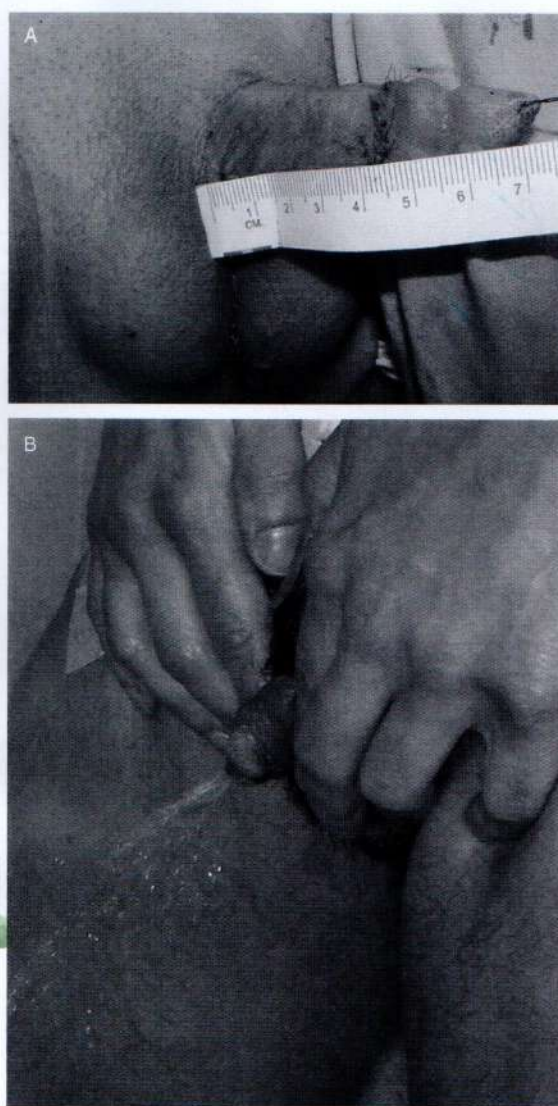
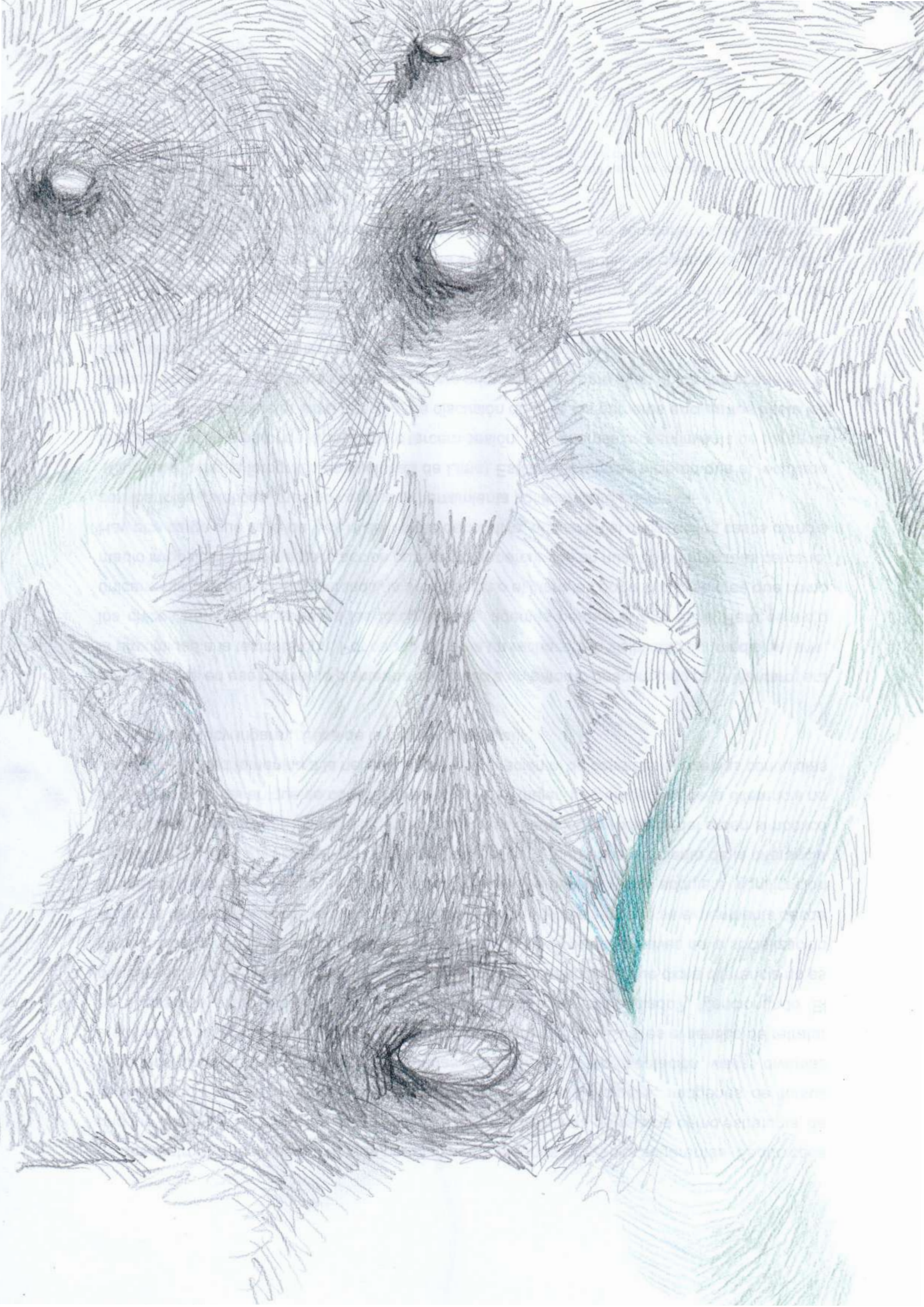


Figure 4 (A) Appearance at the end of surgery. Penile skin is reconstructed using remaining genital flaps. Two testicular prostheses are inserted in the newly created scrotum. (B) Three weeks after surgery, normal voiding while standing is achieved.



reconstruction that can meet the aesthetic and functional requirements of a transgender patient, with a hidden scar in the donor area (5).

Metoidioplasty is considered to be a very good variant of phalloplasty for female-to-male transgenders who desire an aesthetically acceptable neophallus, voiding while standing, and preservation of erogenous sensation (6). The main advantage of metoidioplasty is that it is a one-stage procedure which provides voiding while standing. Since the technique was first introduced by Durfee and Rowland, several definitive modifications have been made to the use of a hormonally enlarged clitoris for penile substitution in transmen, with the aim of better outcomes. The innovation of scrotoplasty joins both labia majora and the insertion of testicular implants, while urethral lengthening has also provided further benefits (7,8). In this review, we detail and evaluate all available techniques of metoidioplasty and report the postoperative results. Our paper was approved by the Ethical Committee of the Belgrade Center for Genitourinary Reconstructive Surgery (No. 7/2018).

Procedures

Metoidioplasty presents one of the procedures for female-to-male gender-affirming surgery. It can be performed separately or as a part of one-stage surgery that includes hysterectomy with oophorectomy and vaginectomy, urethral lengthening, scrotoplasty with insertion of testicular implants, and reconstruction of the neophallic skin (9). Based on recent literature, three different techniques are described: simple, ring, and Belgrade metoidioplasty.

Simple metoidioplasty

Simple metoidioplasty is performed on a good-sized clitoris, which is enlarged by preoperative use of testosterone. The procedure includes a subcoronal skin incision followed by degloving and transection of clitoral suspensory ligaments. The urethral plate is dissected ventrally and divided with additional correcting of the chordee. The remaining clitoral skin with the labia minora and majora is used for a clitoral body covering, giving a bulky appearance of the clitoris. The bottom of the levator muscle is also dissected and sutured in special fashion for better support of the enlarged clitoris. With this technique, the native urethral opening remains in place for possible urethral lengthening in the future. This may create possible problems with skin closure at the new scrotum part and present issues of maintenance

of the normal urine outflow. A urinary catheter is used for urine drainage and to prevent leakage over the surrounding reconstructed skin. The complication rate occurs in less than 5% of cases and mainly consists of malunion or malrotation of the closing skin. Another consideration is related to vaginal removal or preservation (10). One of the main disadvantages is voiding while sitting, and an additional stage with urethral lengthening should be performed for complete patient satisfaction. Despite its limitations, this technique provides a complication-free gender-confirmation surgery with acceptable cost and fast and safe recovery (11).

Hage reported a few modifications of simple metoidioplasty based on urethroplasty (12). In this procedure, a neourethra is formed by combining the urethral plate and labia minora flap. The short plate is proximally divided at the level of the female urethral orifice. Urethral plate dissection is run proximally to distally, compromising its vascularization and leading to a high complication rate. The authors reported that 2.6 procedures were necessary to achieve optimal results in this type of surgery. Simultaneously, Perovic *et al.* reported good results of simple metoidioplasty in 22 patients with a complication rate of 23%, mainly related to urethral reconstruction (13).

Ring metoidioplasty

This technique is similar to simple metoidioplasty but with a difference in dissection of the chordee and division of the suspensory ligaments. All of the additional procedures are included with the aim to lengthen and straighten the clitoris. Another difference is the extension of the urethral plate. With the ring technique, a special dorsal urethral ring flap is harvested from introital vaginal mucosa distally from the hymen. The ring flap is attached to the underlying clitoral bodies allowing its tubularization without pressure. The defect from the donor flap area is closed by 5-0 running resorbable suture. Compared to single metoidioplasty, one of the main improvements is the creation of a ventral urethral plate that is closed with the long vaginal flap for final urethral lengthening (14). The clitoral body is covered with the remaining labial skin creating a small neophallus.

Complications include urethral fistula (10–26%) and stricture (3–5%). Despite the fact that ring metoidioplasty is a one-stage procedure, the complication rate is high and demands further revisions. In almost 30% of individuals, urethral complications are a problem with voiding while standing being the main postoperative issue. Also,

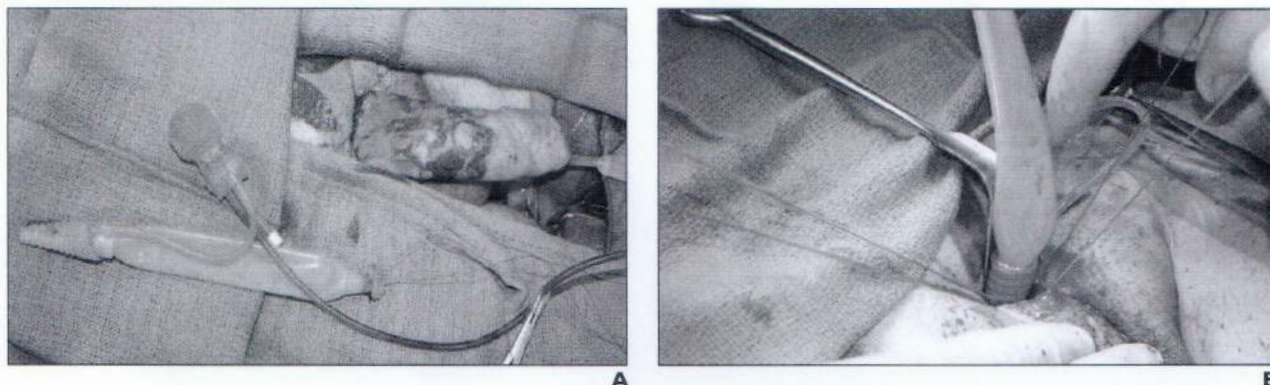


Fig. 6—Anchor sites for erectile devices.

A, Intraoperative photograph of early-30-year-old trans-masculine patient shows erectile device with vascular graft “sock,” which is used to assist in placing fiber wire sutures to anchor device to pubic bone. Also, note acellular dermal matrix tip for graft protection.
B, Intraoperative photograph of early-30-year-old trans-masculine patient shows insertion and fixation of implant to pubic bone.

ed polytetrafluoroethylene (Gore-Tex, W. L. Gore & Associates) or polyester fiber (Dacron, DuPont) graft sheaths using permanent suture, as shown in Figure 6 [24]. Alternatively, the proximal portion of the implant may be directly inserted into the pubic ramus after drilling corticotomies into the bone [23, 25].

For multicomponent inflatable prostheses, the reservoir is placed in the prevesical space or a subrectus pouch, identical to reservoir placement in cisgender men. The pump component is placed within the neoserotum, typically on the side opposite of the vascular pedicle. A testicular implant may be placed within the contralateral hemiscrotum.

Preoperative Workup

Allen Test and Angiography for Radial Forearm Free Flap Phalloplasty

Before free flap transfer, the surgeon must be confident that there is adequate blood supply to the flap and that the donor site deficit is tolerable. In the case of the RFFF, if the radial artery is present and there is no history

of trauma or surgery to the radial artery, then the surgeon must ensure adequate perfusion of the hand via ulnar circulation at physical examination using an Allen test, which has a sensitivity and specificity of 54.5% and 91.7%, respectively [26]. Alternatively, a Barbeau test can be performed. A Barbeau test is similar to an Allen test, but a pulse oximeter is placed on the thumb or index finger to verify return of circulation after the ulnar artery flow is released. In rare instances in which the results of these tests are equivocal or there is concern for anatomic variation due to previous trauma or surgery, an interventional angiogram is obtained to verify that the radial artery can safely be harvested.

CT Angiography

The use of CT angiography (CTA) for microsurgical planning is well documented for autologous breast reconstruction using various donor sites [27, 28]. At Oregon Health and Science University, preoperative CTA is the standard before ALT flap phalloplasty but

is not used for other donor sites. The preoperative measurement of the expected pedicle length has proved invaluable in our experience to predict the ability to elevate the flap using a vascular pedicle and choose the donor leg that has the highest likelihood in achieving this goal. Standard CTA images of the lower extremities from the pelvis to the tibial tuberosity using 1-mm slice image reconstruction in the axial and coronal planes are used to determine the most distant perforator, its source vessel, and the expected pedicle length. Thick-sliced, overlapping maximum intensity projections, as shown in Figure 7, are often useful for better delineating perforating vessels. We particularly look at which side has the most superior origin of the LFCA and which side has more distal perforators, thereby increasing the pedicle length. Intraoperative measurements of pedicle length, as seen in Figure 7B, correlate well to measurements of pedicle length on preoperative imaging. Preoperative CTA also reveals common anatomic variations such as perforators originat-

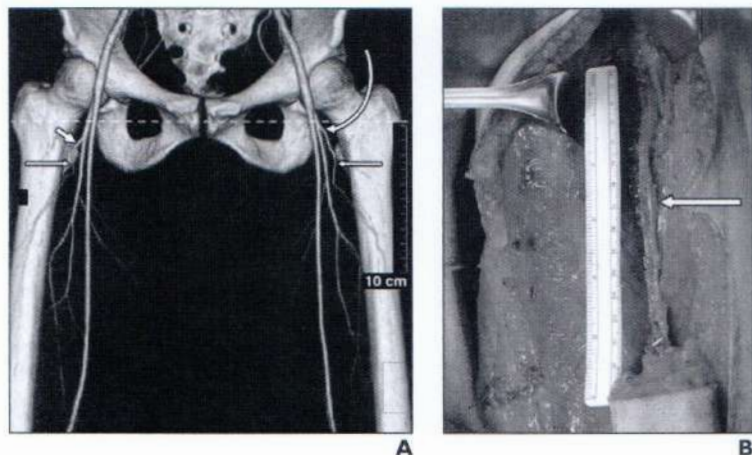


Fig. 7—Preoperative and intraoperative measurements of pedicle length.

A, Coronal maximum-intensity-projection CT angiography (CTA) image of 38-year-old trans-masculine patient who underwent preoperative CTA for planning anterolateral thigh flap phalloplasty. CTA is used to evaluate level of takeoff of lateral femoral circumflex arteries (LFCAs); in this patient, left LFCA (curved arrow) arises cephalad compared with right LFCA (short arrow), making left side more likely to reach recipient site without need for free tissue transfer. Dashed line depicts cephalad location of left LFCA compared with right LFCA. Descending branch (long straight arrows) of LFCA gives rise to donor site.
B, Intraoperative photograph of early-30-year-old trans-masculine patient shows fully dissected descending branch of LFCA (arrow). Pedicle length on preoperative imaging (not shown) correlated well with intraoperative findings.

transsexual por el nombre de un país

donde nació

... y todos sus derechos, vivamos en igualdad de
dad de derechos, pero existe libertad e igualdad
lo que no existe."

Nuestra misión: desear, establecer, promover, apoyar, apoyar
nuestro patrimonio público y todo lo que se relaciona
con el bienestar, también debemos promover, apoyar
y defender los derechos de las personas trans,
a través de los no discriminación, la igualdad de
oportunidades, la igualdad de género.

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