Chapter 15
Surgical Interventions for Gender Dysphoria

Stan J. Monstrey, Marlon Buncamper, Mark-Bram Bouman, and Piet Hoebeke

Abstract For individuals with pronounced gender dysphoria, surgery is the ultimate and the most radical step in the process of gender reassignment and follows a period of real-life experience and hormone treatment.

In this chapter, a complete overview is first provided of all surgical procedures, both in male-to-female and female-to-male transsexuals: These include aesthetic operations, breast surgery, and genital surgical interventions.

For the male-to-female individual, a more in-depth description is provided of facial feminizing surgery (FFS), of breast augmentation, as well as of the different techniques for vaginal reconstruction. Emphasis is placed on functional outcomes, on the reduction of complications, and on aesthetic improvements.

In the female-to-male transsexual, the subcutaneous mastectomy (SCM) or male chest contouring and the different surgical options for phalloplasty or penile reconstruction are described in more detail. The advantages and disadvantages of the different techniques are addressed.

It is concluded that in order to obtain optimal results in transgender surgery, a close cooperation between the different professionals involved is an absolute requirement.

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15.1 Introduction

Most professionals nowadays concur that gender reassignment, or "adjusting the body to the mind," is the best way to assist severely gender dysphoric persons who desire this procedure (Cohen-Kettenis & Kuiper, 1984; Kuiper & Cohen-Kettenis, 1988). Surgery is the ultimate and the most radical step in the process of gender reassignment and follows a period of living in the desired gender role and hormone treatment.

While it might seem that gender reassignment surgery (GRS) would be the inevitable conclusion to gender reassignment, and sought in virtually every case, a significant number of persons who make gender transitions never undergo surgical reassignment. In some cases, this is by choice and, in other cases, by necessity. Still, for most transsexual persons, sex reassignment surgery remains the sine qua non of the reassignment experience since having congruent genitalia is considered essential for the transsexual individual to experience harmony between body and self-identity.

The Standards of Care (SOC) of the World Professional Association of Transgender Health (WPATH) are clinical guidelines intended to provide flexible direction for the treatment of persons with gender identity disorders. These standards are adopted worldwide by most professionals and clearly delineate the indications and the different options for sex reassignment surgery (Coleman et al., 2011). Of course, the availability of professional services, mental health as well as medical professionals, varies enormously per country or state.

The criteria for breast (top) surgery differ from those for genital (bottom) surgery since only one letter of recommendation is required for a breast augmentation or a subcutaneous mastectomy and two letters are required prior to genital surgery. By following this procedure, the mental health professional, the surgeon, and the patient share the responsibility for the decision to perform irrevocable surgery.

As to the requirements for the surgeon, the SOC of WPATH specify that the surgeon performing genital surgery should be a medical board-certified urologist, gynecologist, plastic surgeon, or general surgeon, with specialized competence in genital reconstructive techniques, as indicated by documented supervised training with a more experienced surgeon.

Long-term postoperative follow-up, one of the factors associated with good psychosocial outcome, is strongly encouraged. Such follow-up is important for the patient's further health and provides the surgeon with continuous feedback regarding the benefits and limitations of surgery.

Finally, the need for collaborative care cannot be stressed enough. No single medical specialty can provide comprehensive care to the transsexual patient. Gender dysphoria is a multifaceted condition requiring a multidisciplinary approach. This is particularly true when surgical procedures require several specialists participating simultaneously in the operating suite.

15.2 Sex Reassignment Surgery in the Male-to-Female Transsexual

15.2.1 History of Gender Reassignment Surgery Among Male-to-Female (MtF) Transsexuals

Although Abraham (1931) was the first to describe an intentional sex change operation in a transsexual patient in 1931, this was certainly not the first use of surgery to relieve the agony of persons with irreversible gender dysphoria (Edgerton, 1984). People throughout the world have voluntarily undergone surgery, in the sense of "traumatic alterations," to modify their bodies in such a way as to "change their sex."

Accumulating knowledge of the effects of castration, as witnessed in animals, has been applied to help male-to-female (MtF) transsexuals. Eunuchs have existed since biblical times, and it is unknown to as what extent their castrations were voluntary. It is quite likely that hundreds or thousands of transsexuals have sought and undergone surgeries far riskier and more dramatic in effect than mere castration. In some such surgeries, transsexuals were completely emasculated by total removal of the testes, penis, and scrotum. It is unknown when such practices first occurred, but such surgeries were recorded in ancient Greece and particularly in Rome, known for being sexually permissive.

In personal diaries of the seventeenth century, two rather crude, self-inflicted operations were described as providing great and lasting subjective relief of gender dysphoria. These emasculating tactics were suppressed in the Christian world (with the exception of the castration of boys to maintain voice quality), but in Asia they have continued uninterrupted to the present, notably in South-East Asia, India (e.g., the Hijra), and surrounding countries (Monstrey, Selvaggi, & Ceulemans, 2007).

Prior to the second half of the twentieth century, there were legal restraints prohibiting the modification of gender by surgery. These restrictions loosened considerably in the latter half of that century only then resulting in the development of modern gender reassignment surgery. With rapid advances in the fields of endocrinology and plastic surgery following World War II, comprehensive medical and surgical treatments for transsexualism became available. Indeed, during the 1950s, transsexual women benefited enormously from newly available female sex hormones, which fostered breast development, softening of the skin, and, in time, female body contours.

The first vaginoplasty in a MtF transsexual was performed in Denmark in 1952 with a skin graft, but it was Dr. G. Burou (1973), a French gynecologist working in Casablanca, Morocco, who has been credited with the invention of the anteriorly pedicled penile skin flap inversion technique as the technique of choice (still nowadays) for vaginoplasty in MtF transsexuals. In this technique, the penile skin is kept attached at the pubic region and is invaginated into the newly created vaginal cavity. Except for Casablanca, access to this new, experimental surgery was very limited,

and in the USA, despite the groundbreaking work of Harry Benjamin (1966), an endocrinologist with a specific interest in transsexualism, these surgeries were still virtually unknown in the mid- to late 1960s.

In 1966, surgeons at the Johns Hopkins Medical Centre began performing a limited number of MtF gender reassignment surgery (GRS) operations, and a couple of years later, they were followed by surgeons at Stanford University and in Trinidad, Colorado.

In Europe, beginning in the 1970s, the University Hospital of the Free University of Amsterdam (now called the VU University Medical Center) became the leading center in medical and surgical treatment of patients with severe gender dysphoria, under the leadership of Louis Gooren, endocrinologist, and F. Bouman, plastic surgeon. Their successors Peggy Cohen-Kettenis and Joris Hage further expanded the lead of Amsterdam in the treatment of transsexualism.

15.2.2 Overview

MtF gender reassignment surgery can be classified into three categories:

1. *Nongenital, non-breast* surgical interventions: Facial feminizing surgery, liposuction, lipofilling, gluteal implants, reduction of the Adam's apple, voice-raising surgery, hair reconstruction surgery, and various other cosmetic procedures
2. *Breast* (top) surgery: Augmentation mammoplasty
3. *Genital* (bottom) surgery: Penectomy, castration, vaginoplasty, clitoroplasty, vulvoplasty (plasty stands for the creation or the reconstruction of)

15.2.3 Non-breast, Nongenital Surgery

MtF transsexual patients treated with estrogens can realistically expect some degree of breast growth, some redistribution of body fat to approximate a female body appearance, decreased upper body strength, softening of the skin, decrease in body hair, and slowing or cessation of loss of scalp hair, but no feminization of facial features nor of the voice.

Beard density is also not significantly affected by cross-sex hormone administration. Removal of facial hair, via electrolysis or laser depilation, is a generally safe but costly and time-consuming process. However, in most cases, it greatly facilitates passing in the desired gender role.

A growing number of MtF transsexuals request non-breast, nongenital, feminizing surgical procedures to assist in their real-life experience. These mainly include liposuction of the waist, hair reconstruction surgery, antiaging operations, Adam's apple shaving, otoplasty or ear correction, and facial feminizing surgery. According

to the SOC, none of these feminizing interventions require letters of recommendation from mental health professionals.

The two most common surgical interventions specifically performed in the MtF transsexual patient are facial feminizing surgery (FFS) and a reduction of the Adam's apple with possible voice surgery.

15.2.3.1 Facial Feminizing Surgery

In initial contacts, it is most often the face that provides the cues about the person, including gender. For the transsexual patient, nothing is more important than to appear externally congruent with the internal and emotional self.

Although the face, like most physical attributes, varies considerably in projection and form, there is an overlap of masculine and feminine forms and few remarkable differences between the two. Yet it is relatively easy to distinguish between female and male faces. Therefore, some basic attributes of what are commonly perceived to be masculine and feminine features have been set forth. These are the standards which facial surgery addresses, as part of an overall sex reassignment surgery.

The most frequently performed cosmetic surgical intervention includes (Hage, Becking, de Graaf, & Tuinzing, 1997):

- A correction of the typical male brow bossing, eventually combined with a contouring of the bone around the eyes and elevation of the brows through a standard forehead lift
- Cheek augmentation with an implant or with soft tissue filling
- A rhinoplasty to refine (mostly reduce) the contour, the width, the tip, and the tilt of the nose
- Modification of the chin with a small implant or through bony correction and repositioning
- Softening of the lower jaw contouring
- Various forms of hair reconstruction surgery

15.2.3.2 Chondrolaryngoplasty and Voice Surgery

Unlike hormonal therapy for the female-to-male patient, estrogen does not have any substantial or lasting influence on voice pitch, and speech therapy alone often does not produce satisfactory results. Even after transition, an individual may be identified as a man because of voice, and this occurs most often on the telephone. This can cause social and psychological problems. Surgical procedures to raise the patient's voice pitch ("crico-thyroidopexy" procedure) are performed with the aim of assisting social integration and can greatly improve self-esteem in some cases. In many patients, this procedure is combined with a reduction of the Adam's apple (Isshiki, 1989).

15.2.4 Breast Augmentation

Although genital reconstruction is the ultimate surgical request of the MtF transsexual patient, for many, breast augmentation (or breast "reconstruction") is equally important to increase subjective feelings of femininity. Mammoplasty provides a more feminine profile, facilitating adjustment. The presence of breasts significantly increases the factors involved in passability.

As mentioned previously, there are few changes that occur, even after years of estrogen therapy, that create a feminine appearance in the biologically male body. Hormonal therapy has no effect on voice, hand, feet, or shoulder dimensions, and while some breast formation occurs, for many, it is insufficient.

Mammogenesis in MtF transsexuals receiving estrogens follows a pattern similar to female pubertal mammogenesis, but it is not exclusively dose responsive, and about 2/3 to 3/4 of the male-to-female transsexuals do require an augmentation mammoplasty (Kanhai, Hage, Asscheman, & Mulder, 1999) because the preoperative condition of the breasts only responds to the softly pointed form seen in young girls or the small conical form seen in young adolescents.

Since, ultimately, breast prostheses are implanted in transsexuals with "young adolescent" breast development, the patient should be informed that the complex feminine form and age-related changes of the breast cannot be imitated by using symmetric round prostheses (Kanhai et al., 1999).

Other anatomical differences which should be taken into consideration in male-to-female transsexual patients are the larger width of the male breast, a stronger and a more developed muscle of the breast, and the smaller dimension of nipple and areola. Usually a 25 % larger volume of breast prostheses is chosen in MtF transsexuals compared to a breast augmentation in a biologically female patient, but even with a larger prosthesis, it is often impossible to avoid an abnormally wide cleavage between the breasts. The nipple and areola should always overlie the prosthesis centrally, and a position of these prostheses that is too much to the midline could result in extremely divergent nipples with an unacceptable appearance of the breast (Laub & Fisk, 1974).

Despite some sexual differences in chest wall and mammary anatomy, the implantation of mammary prostheses is not essentially different from breast augmentation in a biologically female patient, except that, usually, larger prostheses are used.

The same choices apply as to the kind of prostheses, the position of the pocket, the surgical approach, etc. (Monstrey et al., 2001).

The general complications of a breast augmentation are the same as in any surgical intervention: bleeding, infection, and/or delayed wound healing. However, these complications occur infrequently in augmentation mammoplasty. Complications specific to augmentation mammoplasty can include a decreased sensation in the nipple and/or part of the breast, capsular contraction (formation of dense scar tissue around the prosthesis), leakage of the content of the prostheses, and migration of the prostheses to an unnatural position.

In most institutions, breast augmentation is often performed during the same surgical procedure as the genital surgery. In this case, the operation starts with the breast augmentation, which is the most sterile part of the intervention. Both procedures, however, can even be carried out simultaneously if two surgical teams are available.

Recently, breast augmentation by the technique of lipofilling (fat injection) can be a valuable alternative to an augmentation with implants, especially in patients with enough subcutaneous fat who require only a limited increase in breast size.

Postoperative follow-up controls are mandatory in all patients undergoing breast augmentation. Several cases of breast cancer have been described in transsexuals after mammoplasty (Ganly & Taylor, 1995). The degree of risk may well be in proportion to the amount of hormones administered, but any person receiving feminizing hormonal therapy runs the same risk of breast cancer as does a genetic woman, and for both groups, family history of the disease is a risk factor. Additional investigation with mammography, ultrasound, or magnetic resonance can be indicated.

15.2.5 Genital Surgery

Karim, Hage, and Cuesta (1996) described the aim of genital reassignment surgery in male-to-female transsexual patients as follows:

> "*to create a perineo-genital complex as feminine in appearance and function as possible and free of poorly healed areas and painful scars. The urethra or urinary conduit should be shortened in such a way that the direction of the urinary stream is downward in the sitting position and it should be free of stenosis (narrowing) or fistulas (leakage). The neovagina should, ideally, be lined with moist, elastic and hairless. Its depth should be at least 10 cm and its diameter 30 mm. The sensation should be sufficient to provide satisfactory erogenous stimulus during sexual intercourse. Ideally, all these requirements should be met without overly-complex surgery, and addressing them should not create new lesions on other parts of the body*."

Orchidectomy (castration), amputation of the penis, creation of the new vaginal cavity, the lining of this cavity, reconstruction of a urethral opening, and, finally, construction of the labia and clitoris are the major steps in every procedure.

Although the surgical techniques for vaginoplasty have evolved significantly, it must be stressed that both medical and surgical treatments are rarely perfect. Revisional surgery is sometimes required to optimize aesthetic results. Most patients require lubrication for sexual intercourse, and, of course, pregnancy is not possible.

Different methods exist for the lining of a newly reconstructed vagina: nongenital or penile skin grafts, penile-scrotal skin flaps, nongenital skin flaps, and reconstruction with a piece of bowel (Karim et al., 1996). However, the anteriorly pedicled penile skin flap inversion technique, as first performed by Dr. Burou (1973) in Casablanca, is still considered the technique of choice for vaginoplasty in male-to-female transsexuals. This penile skin flap is often combined with a (mostly) small

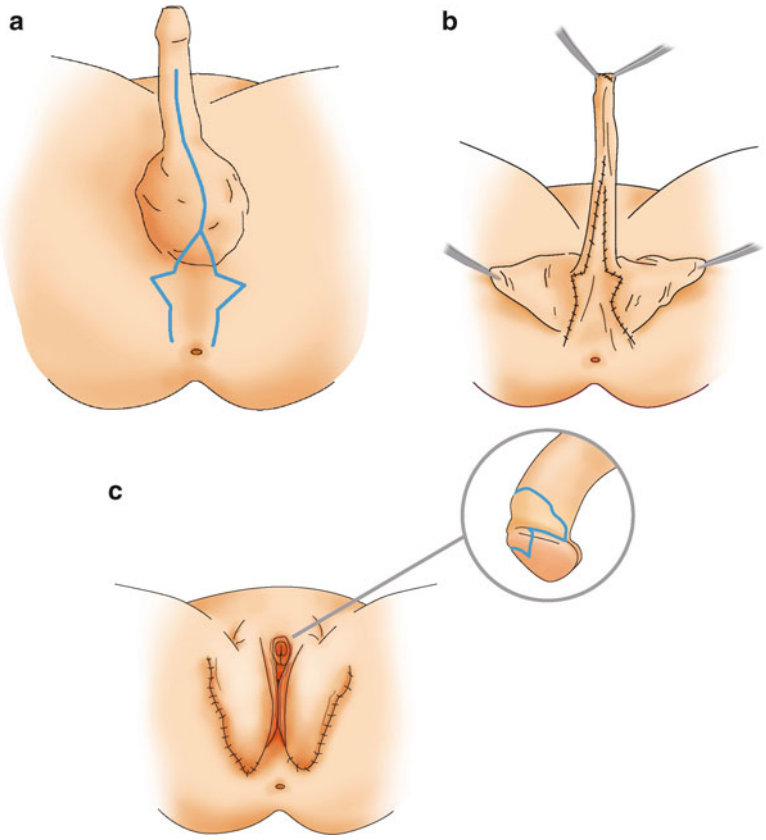

Fig. 15.1 (**a**–**c**) Vaginoplasty; penile inversion technique

dorsally based scrotal flap (see Fig. 15.1a, b, c) to widen the entrance of the vagina and to "break" the circular opening (Karim, Hage, Bouman, de Ruyter, & van Kesteren, 1995).

There are several advantages to penile skin flaps. They demonstrate less tendency to contract. In the event of inadvertent damage to the rectum, correction is easier, as it is immediately covered with vascularized tissue (Karim et al., 1995). Local innervation is provided and the flap is virtually hairless. Although pedicled flaps have much less tendency to contract than skin grafts, patients are still required to use a dilator postoperatively for 6 months.

Several refinements of the vaginoplasty using the inverted penile-scrotal skin flap technique have been described (Karim et al., 1995; Selvaggi et al., 2005). These include preoperative hair removal of the area at the base of the penis and posterior scrotum, preoperative bowel preparation, the use of a surgical drape with a rectal condom to guide the blunt dissection of the vaginal cavity, and the use of a double silicone vaginal stent to create and maintain a vaginal cavity of adequate dimension.

To consistently obtain a long and wide vagina, several authors recommend dissecting a wide and deep pocket during surgery. Additionally, they advise using a full-thickness graft (FTG) from the scrotum or abdomen if the amount of penile skin is insufficient to line the neovagina.

Finally, to produce a functional and aesthetic outcome, they advise near-complete resection of the corpus spongiosum, eversion of the urethral mucosa, and construction of the clitoral prepuce and labia minora. At present, most surgeons performing a clitoroplasty in transsexual patients use the dorsal portion of the glans penis with the dorsal neurovascular pedicle (Eldh, 1993; Giraldo et al., 2004; Hage & Kesteren, 1995). A novelty in the construction of the labia minora and, more specifically, the construction of a clitoral hood is to use the thin inner layer of penile foreskin which is harvested in continuity with the glans flap. It is only this way that the very delicate features of the anterior commissure of the vulva where the clitoris is located and where the labia minora start from the clitoral hood can be reconstructed in a naturally appearing way (Selvaggi et al., 2005).

The use of a pedicled intestinal transplant is only recommended in patients with an unsatisfactory previous vaginoplasty and with a short vaginal length and in the very young patients with a very small penis due to puberty halting hormones where it can be the first choice (and even the only technique) to obtain a vagina with adequate depth. The advantages of this technique are the length it provides, as well as a mucosal texture and natural lubrication. Disadvantages are the need for additional abdominal surgery and the possible long-term complications such as stasis of mucus, diversion or ulcerative colitis, and introital stenosis.

The normal postoperative course, when an anteriorly pedicled penile skin flap technique has been used in combination with a posterior scrotal flap, is the following.

The patient remains in bed for 4–5 days, with a dilator firmly in place to maintain the maximal dimensions of the vagina. Fractionized heparin is provided subcutaneously to prevent eventual thromboses. After 5 days, the dilator is removed, and the patient is allowed to ambulate. The neovaginal cavity is cleansed daily with an Iso-Betadine solution. The following day, the urethral catheter is removed. The patient is usually discharged on the seventh or eighth postoperative day and is instructed in the care of the neovagina.

The period of time that the dilator remains out is gradually increased over the following 3–6 months. Patients must know that dilation is a lifelong occurrence, but, if sexually active, the frequency can be greatly diminished.

Early postoperative complications include bleeding (usually resolved by applying some pressure), infection, or impaired wound healing. One specific complication related to the vaginoplasty procedure is a rectovaginal fistula (a connection between the rectum and the vagina), as the vaginal cavity needs to be created between the prostate urethra anteriorly and the rectum posteriorly. The rectum has a rather thin wall, and care must be taken to avoid a perforation. If this complication were to occur, a double-layer closure is performed, which usually heals without problem since a preoperative bowel prep is routinely performed.

Possible late complications include stenosis of the new urethral meatus.

15.3 Sex Reassignment Surgery in the Female-to-Male Transsexual

15.3.1 Overview

A complete list of gender reassignment surgery procedures in the female-to-male (FtM) transsexual can include:

1. *Non-breast, nongenital* surgery: Voice surgery (rare), liposuction, lipofilling, pectoral implants, and various cosmetic procedures.
2. *Breast* (top) surgery: Subcutaneous mastectomy (SCM).
3. *Genital* (bottom) surgery: Hysterectomy-ovariectomy, reconstruction of the fixed part of the urethra which can be combined with a metaidoioplasty (reconstruction of a micropenis) or with a phalloplasty (penile reconstruction) employing a pedicled (kept attached) or free vascularized flap (tissue transfer including microsurgical connection of blood vessels and nerves), vaginectomy (resection of the vagina), scrotoplasty (reconstruction of the scrotum), and implantation of erection and/or testicular prostheses.

In FtM transsexuals the operative procedures are usually performed in different stages: First is the subcutaneous mastectomy, which is often combined with a hysterectomy-ovariectomy. The next operative procedure consists of the genital transformation and includes a vaginectomy, a reconstruction of the horizontal part of the urethra, a scrotoplasty, and a penile reconstruction usually with a radial forearm flap (or an alternative). After about 1 year, penile (erection) prosthesis and testicular prostheses can be implanted when sensation has returned to the tip of the penis.

15.3.2 Subcutaneous Mastectomy

15.3.2.1 General Principles

Because hormonal treatment has little influence on breast size, the first (and, arguably, most important) surgery performed in the FtM transsexual is the creation of a male chest by means of a SCM. This procedure allows the patient to live more easily in the male role (Beer et al., 2001; Hage & Kesteren, 1995; Symmers, 1968) and thereby facilitates the "real-life experience," a prerequisite for genital surgery.

The goal of the SCM in a FtM transsexual patient is to create an aesthetically pleasing male chest which includes removal of breast tissue and excess skin and reduction and proper positioning of the nipple and areola, while minimizing chest wall scars (Hage & Kesteren, 1995). Many different techniques have been described to achieve these goals, and in their large and well-documented series, Monstrey et al. (2008) described an algorithm of five different techniques to perform an aesthetically satisfactory SCM. Regardless of the technique, it is extremely important

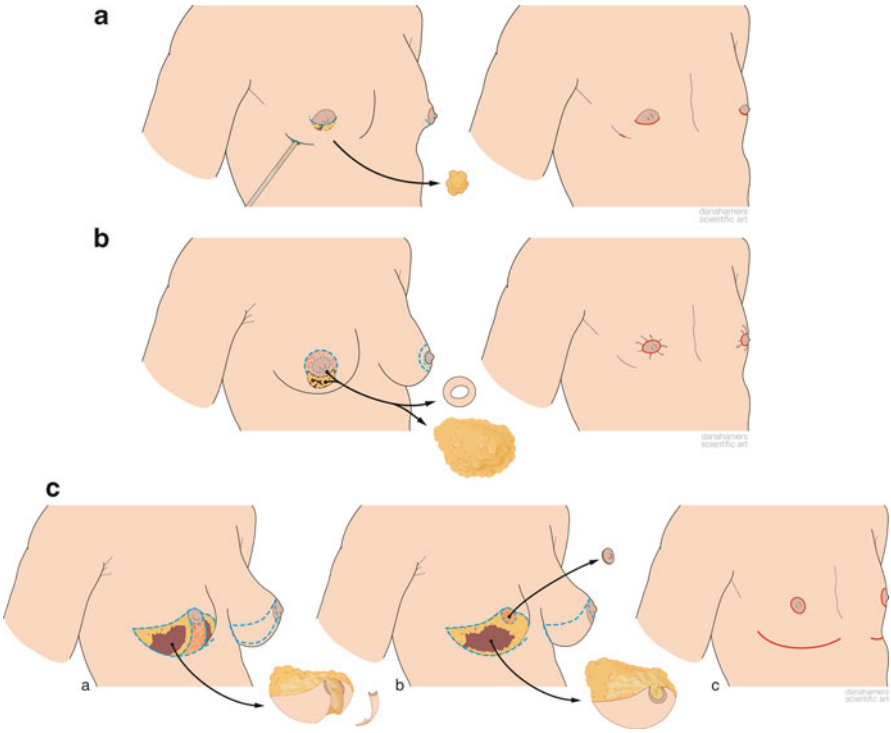

Fig. 15.2 Subcutaneous mastectomy. (**a**) Semicircular technique, without skin resection. (**b**) Concentric circular technique. (**c**) Double-incision technique with pedicled nipple or free nipple graft. Illustrations by Dana Hamers Scientific Art. Figures are reprinted with permission from the copyright holders

to preserve all subcutaneous fat when dissecting the glandular tissue from the flaps. This ensures thick flaps that produce a pleasing contour. Liposuction is only occasionally indicated laterally or to attain complete symmetry at the end of the procedure.

15.3.2.2 Current Techniques

The *semicircular* technique is essentially the same procedure as that described by Webster in 1946 (Webster, 1946) for gynecomastia. A semicircular incision is made, usually around the lower side of the areola, to resect the glandular tissue. It is useful for individuals with smaller breasts and elastic skin. A sufficient amount of glandular tissue should be left beneath the nipple-areola complex in order to avoid a depression.

The particular advantage of this technique is the small and well-concealed scar which is confined to (the lower half of) the nipple-areola complex (see Fig. 15.2a).

In cases of smaller breasts with large prominent nipples, the *transareolar* technique is used. This allows for subtotal resection and immediate reduction of the nipple. The resulting scar traverses the areola horizontally and passes around the upper aspect of the nipple.

The *concentric circular* technique is used for breasts with a medium-sized skin envelope (B cup) or in the case of smaller breasts with poor skin elasticity. The double concentric incision enables the removal of a calculated amount of skin in the vertical or horizontal direction (Hage & Kesteren, 1995). A purse-string suture to reduce the diameter of the final circular scar is placed and set to the desired areolar diameter (usually 25–30 mm). The advantage of this technique is that it allows for reduction and/or repositioning of the areola and that the resulting scar will be confined to the circumference of the areola (see Fig. 15.2b).

The *extended concentric circular* technique is similar to the concentric circular technique but includes one or two additional triangular excisions of skin and subcutaneous tissue lateral and/or medial. This technique is useful for correcting skin excess and wrinkling produced by larger-sized breasts.

The *free nipple graft* technique has been proposed by several authors for patients with large and pendulous breasts (Cregten-Escobar, Bouman, Buncamper, & Mullender, 2012; Monstrey et al., 2001). It consists of harvesting the nipple-areola complex (NAC) as a full-thickness skin graft, amputating the breast, and grafting the NAC onto its new location on the chest wall. The advantages of the free nipple graft technique are easy chest contouring, excellent exposure, and more rapid resection of tissue, as well as nipple reduction, areola resizing, and repositioning (see Fig. 15.2cii). The disadvantages are the long residual scars, NAC pigmentation and sensory changes, and the possibility of incomplete graft take.

15.3.2.3 Complications

Postoperative complications are rather uncommon but can include hematoma (most frequent, despite drains and compression bandages), (partial) nipple necrosis, and abscess formation. This underscores the importance of achieving good hemostasis (control of bleeding) intraoperatively. Even in the patients without complications, about 25 % required an additional procedure to improve the aesthetic results. The likelihood of an additional aesthetic correction should be discussed with the patient in advance (Monstrey et al., 2001).

Finally, it is important to note that there have been reports of breast cancer after bilateral SCM in this population (Burcombe, Makris, Pittam, & Finer, 2003) since in most patients the preserved NAC and the always incomplete glandular resection leave behind tissue at risk of malignant transformation.

15.3.3 Phalloplasty

15.3.3.1 General Principles

In performing a phalloplasty for a FtM transsexual, the surgeon should reconstruct an aesthetically appealing neophallus, with erogenous and tactile sensation, which enables the patient to void while standing and to have sexual intercourse like a natural male, in a one-stage procedure (Gilbert et al., 1987; Hage, Bouman, de Graaf, & Bloem, 1993). The reconstructive procedure should also provide a normal scrotum, be predictably reproducible without functional loss in the donor area, and leave the patient with minimal scarring or disfigurement.

Despite the multitude of flaps that have been employed and described (often as case reports), the radial forearm flap, a free vascularized flap prelevated from the forearm and vascularized by the radial artery (see Fig. 15.3a), is universally considered the "gold standard" in penile reconstruction (Chang & Hwang, 1984; Gilbert et al., 1987; Hage et al., 1993; Hage & De Graaf, 1993; Sadove, Sengezer, McRobert, & Wells, 1993).

In the largest series to date (almost 300 patients), Monstrey et al. (2009) recently described the technical aspects of radial forearm phalloplasty and the extent to which this technique, in their hands, approximates the criteria for ideal penile reconstruction.

15.3.3.2 Technique

For the genitoperineal transformation (vaginectomy, urethral reconstruction, scrotoplasty, phalloplasty), two surgical teams operate at the same time: In the perineal area, the urologist performs a vaginectomy and lengthens the urethra with mucosa of the minor labia. The vaginectomy consists of a resection of the mucosa of the vagina. This reconstruction of the fixed part of the urethra is combined with a scrotal reconstruction by means of two transposition flaps of the greater labia resulting in a very natural looking bifid (with two parts) scrotum (see Fig. 15.3b, c).

Simultaneously, the plastic surgeon dissects the free vascularized flap of the forearm. The creation of a phallus with a tube-in-a-tube technique is performed with the flap still attached to the forearm by its vascular pedicle: The inner tube is for the urinary conduit; the outer tube is to give enough volume to the penis. A small skin flap and a skin graft are used to create a corona (border) that simulates the glans of the penis.

Once the urethra is lengthened and the acceptor vessels are dissected, the free flap can be transferred to the pubic area where first the urethral anastomosis is connected. Thereafter, the radial artery is microsurgically connected to the common femoral urethra in an end-to-side fashion, and the venous anastomosis is performed between the cephalic vein and the greater saphenous vein. One forearm nerve is connected to the ilioinguinal nerve for protective sensation, and the other nerve of

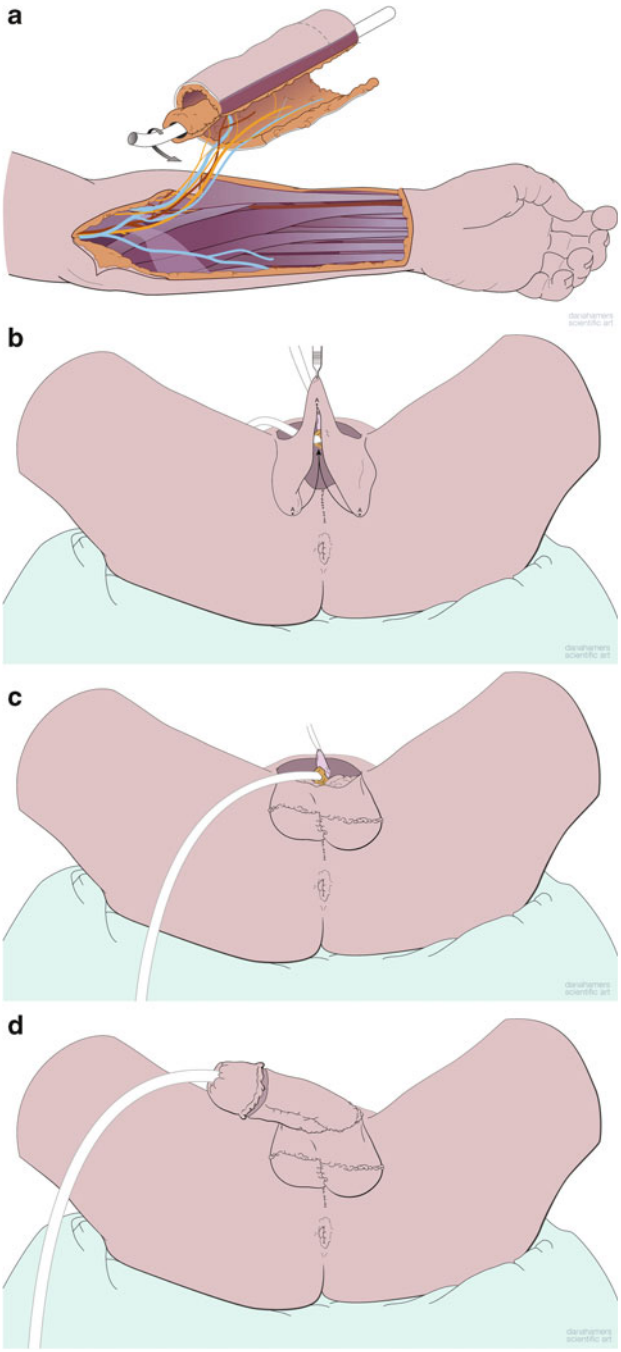

Fig. 15.3 (**a**) The radial forearm flap, the "gold standard" in penile reconstruction. (**b** and **c**) Scrotal reconstruction by means of two transposition flaps of the greater labia. (**d**) Radial forearm flap phalloplasty. Illustrations by Dana Hamers Scientific Art. Figures are reprinted with permission from the copyright holders

the arm is anastomosed to one of the dorsal clitoral nerves for erogenous sensation. The clitoris is buried underneath the penis, thus keeping the possibility to be stimulated during sexual intercourse with the neophallus. All patients receive a suprapubic urinary diversion postoperatively. The patients remain in bed during a 1-week postoperative period, after which the transurethral catheter is removed and voiding has begun. The average hospital stay for the phalloplasty procedure is two and a half weeks.

Tattooing of the glans could be performed after a 2–3-month period, before sensation returned to the penis. Implantation of the testicular and erection prostheses is undertaken typically after 1 year when sensation has returned to the top of the penis.

15.3.3.3 The Ideal Goals of Penile Reconstruction

What can be achieved with this radial forearm flap technique as to the ideal requisites for penile reconstruction (Monstrey et al., 2009)?

1. *Is It a One-Stage Procedure?*
   Already a long time ago, Hage and De Graaf (1993) stated that a complete penile reconstruction with an erection prosthesis never can be performed in one single operation. Nowadays, most GRS surgeons perform the SCM first and most often in combination with a total hysterectomy and ovariectomy. Erection prostheses are implanted only after 1 year.
2. *Is the Phallus Aesthetic?*
   The aesthetic advantages of the radial forearm flap include the following: The flap is thin and pliable allowing the construction of a normal-sized, tube-in-a-tube penis; the flap is easy to dissect and is predictably well vascularized, making it safe to perform an (aesthetic) glans-plasty at the distal end of the flap. The final cosmetic outcome of a radial forearm phalloplasty (see Fig. 15.3d) is a subjective determination, but the ability of most patients to shower with other men or to go to the sauna is the usual cosmetic barometer.
3. *With Tactile and Erogenous Sensation?*
   Of the various flaps used for penile reconstruction, the radial forearm flap has the greatest sensitivity.

   Selvaggi, Monstrey, Ceulemans, et al. (2007) always connect one forearm nerve to the ilioinguinal nerve for protective sensation and the other forearm nerve with one dorsal clitoral nerve. The denuded (skin removed) clitoris was always placed directly below the reconstructed penis. Later manipulation of the neophallus allowed for stimulation of the still-innervated clitoris. After 1 year, all patients had regained tactile sensitivity in their penis, which is an absolute requirement for protection and safe insertion of an erection prosthesis (Selvaggi, Monstrey, Ceulemans, et al., 2007; Selvaggi, Monstrey, Hoebeke, et al., 2007).

   In a long-term follow-up study on postoperative sexual and physical health, more than 80 % of the patients reported improvement in sexual satisfaction and

greater ease in reaching orgasm (100 % in practicing postoperative FtM transsexuals) (De Cuypere et al., 2005).

4. *Could the Patients Void While Standing?*
   For FtM transsexuals undergoing a phalloplasty, the ability to void while standing is a high priority (Selvaggi, Monstrey, Ceulemans, et al., 2007). Unfortunately, the reported incidences of urological complications, such as urethrocutaneous fistulas (leakage), stenosis and strictures (narrowing of urethral tube), and hair growth within the urethra, are extremely high in all series of phalloplasties, even up to 80 %. In their series of radial forearm phalloplasties, Hoebeke et al. (2005) still reported a urological complication rate of 41 %, but the majority of these early fistulas closed spontaneously, and ultimately *all* patients were able to void through the newly reconstructed penis.
5. *With Minimal Morbidity?*
   Complications following phalloplasty include the general complications attendant to any surgical intervention and, more specifically, the already mentioned fistulas and/or stenosis. Other complications are related to the free tissue transfer. The total flap failure in the series of Monstrey et al. (2009) was very low (<1 %), despite a somewhat higher anastomotic revision rate (12 %). About 7 % of the patients demonstrated some degree of skin slough or partial flap necrosis. This was more often the case in smokers, in those who insisted on a large-sized penis requiring a larger flap, and also in patients having undergone anastomotic revision.
6. *No Functional Loss and Minimal Scarring in the Donor Area*
   The major drawback of the radial forearm flap has always been the unattractive donor site scar on the forearm. However, Selvaggi, Monstrey, Hoebeke, et al. (2007) conducted a long-term follow-up study of 125 radial forearm phalloplasties and did not find any major or long-term functional and surprisingly limited aesthetic impairment after harvesting such a large forearm flap.
7. *Normal Scrotum?*
   For the female-to-male patient, the goal of creating natural-appearing genitals also applies to the scrotum. The novel scrotoplasty technique described by Selvaggi et al. combines an advancement with an anterior rotation of labial skin and the excellent aesthetic outcomes of this male-looking (anteriorly located) scrotum; the functional advantage of fewer urological complications and the easier implantation of testicular prostheses make this the technique of choice (Hoebeke, De Cuypere, Ceulemans, & Monstrey, 2003).
8. *Allowing Sexual Intercourse?*
   In a radial forearm phalloplasty, the insertion of erection prosthesis is required in order to engage in sexual intercourse. A major concern regarding erectile prostheses is the long-term results of these devices showing high complication rates (Hoebeke et al., 2005).

Fig. 15.4 Metaidoioplasty

15.3.3.4 Alternative Phalloplasty Techniques

1. *Metaidoioplasty*
   A metaidoioplasty uses the (hypertrophied) clitoris to reconstruct a microphallus in combination with a lengthening of the urethra. FtM patients interested in this procedure should be informed preoperatively that voiding while standing cannot be guaranteed and that sexual intercourse will not be possible (see Fig. 15.4). The major advantages of metaidoioplasty include the complete lack of scarring outside the genital area and the substantially lower costs. Complications of this procedure also include urethral obstruction and/or urethral fistula.
2. *Fibula Flap*
   There have been several reports on penile reconstruction with the fibular flap of the lower leg which includes a piece of bone and is based on the peroneal artery and vein. The advantage of the fibular flap is that it makes sexual intercourse possible without a penile prosthesis. The disadvantages are a pointed deformity to the distal part of the penis when the extra skin can glide around the end of fibular bone and that a permanently erected phallus is impractical.

   Many authors seem to agree that the fibular osteocutaneous flap is an optimal solution for penile reconstruction in a natal male (Sengezer, Ozturk, Deveci, & Odabasi, 2004), e.g., after trauma or oncological resection.
3. *New Surgical Developments: The Perforator Flaps*
   Perforator flaps (flaps based on small blood vessels only) are considered the ultimate form of tissue transfer. Donor site morbidity is reduced to an absolute

minimum, and the usually large vascular pedicles provide an additional range of motion or an easier vascular anastomosis. At present, the most promising perforator flap for penile reconstruction is the pedicled anterolateral thigh (ALT) flap which could be an attractive alternative to the radial forearm phalloplasty. The donor site is less conspicuous, and secondary corrections at that site are easier to make. The disadvantages of this flap are the usually excessive thickness of the flap in these biologically female patients and the additional difficulty reconstructing a penile urethra since a tube-in-a-tube technique is rarely possible because of the fact that the subcutaneous fatty layer is too thick.

Composite tissue allograft (CTA) or transplantation of a penis from a donor is not really considered as a surgical option to date because of the lack of a "vital" indication and because of the burden of immunodepressive therapy.

15.4 Conclusion: The Importance of a Multidisciplinary Approach

Gender reassignment, particularly reassignment surgery, requires close cooperation between the different surgical specialties. Therefore, professionals who unite for the purpose of creating a gender reassignment program should be aware of the necessity of a strong alliance between the plastic surgeon, the urologist, and the gynecologist. In turn, the surgeons must commit to the extended care of this unique population which, by definition, will protract well into the future.

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