Sex Reassignment Surgery in the Female-to-Male Transsexual

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ABSTRACT

In female-to-male transsexuals, the operative procedures are usually performed in different stages: first the subcutaneous mastectomy which is often combined with a hysterectomy-ovarectomy (endoscopically assisted). 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 one year, penile (erection) prosthesis and testicular prostheses can be implanted when sensation has returned to the tip of the penis. The authors provide a state-of-the-art overview of the different gender reassignment surgery procedures that can be performed in a female-to-male transsexual.

KEYWORDS: Genital surgery, transsexual, gender reassignment surgery, phalloplasty, subcutaneous mastectomy

Transsexual patients have the absolute conviction of being born in the wrong body and this severe identity problem results in a lot of suffering from early childhood on. Although the exact etiology of transsexualism is still not fully understood, it is most probably a result of a combination of various biological and psychological factors. As to the treatment, it is universally agreed that the only real therapeutic option consists of "adjusting the body to the mind" (or gender reassignment) because trying to "adjust the mind to the body" with psychotherapy has been shown to alleviate the severe suffering of these patients. Gender reassignment usually consists of a diagnostic phase (mostly supported by a mental health professional), followed by hormonal therapy (through an endocrinologist), a real-life experience, and at the end the gender reassignment surgery itself.

As to the criteria of readiness and eligibility for these surgical interventions, it is universally recommended to adhere to the Standards of Care (SOC) of the WPATH (World Professional association of Transgender Health)[1]. It is usually advised to stop all hormonal therapy 2 to 3 weeks preoperatively.

The two major sex reassignment surgery (SRS) interventions in the female-to-male transsexual patients that will be addressed here are (1) the subcutaneous mastectomy (SCM), often combined with a hysterectomy/ ovariectomy; and (2) the actual genital transformation consisting of vaginectomy, reconstruction of the fixed part of the urethra (if isolated, metoidioplasty), scrotoplasty and phalloplasty. At a later stage, a testicular prostheses and/or erection prosthesis can be inserted.
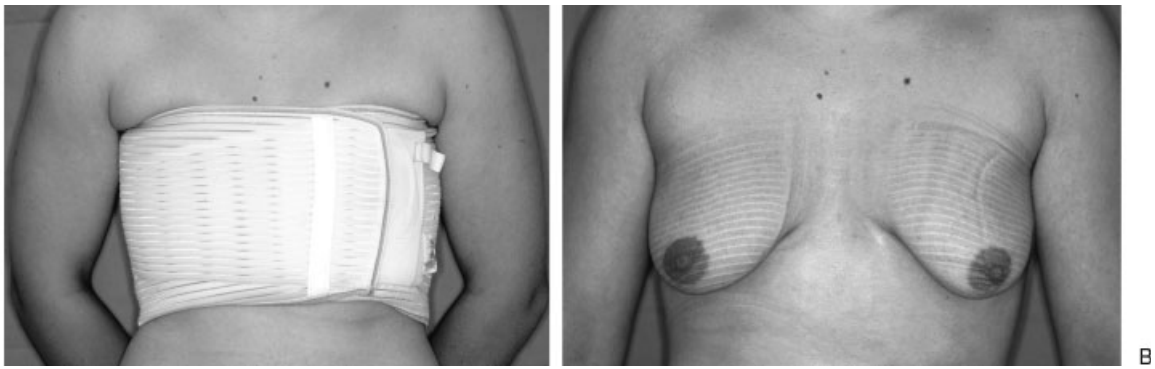
Figure 1 (A,B) Result of long-term "breast binding."

SUBCUTANEOUS MASTECTOMY

General Principles

Because hormonal treatment has little influence on breast size, the first (and, arguably, most important) surgery performed in the female-to-male (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[2–5] 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, reduction and proper positioning of the nipple and areola, obliteration of the inframammary fold, and mini-mization of chest-wall scars.[4,5] Many different techniques have been described to achieve these goals and most authors agree that skin *excess*, not breast volume, is the factor that should determine the appropriate SCM technique.[2–5] Recently, the importance of the skin *elasticity* has also been demonstrated and it is important to realize that in this patient population, poor skin quality can be exacerbated when the patient has engaged in years of "breast binding" (Fig. 1).[6]

In the largest series to date, Monstrey et al[6] described an algorithm of five different techniques to perform an aesthetically satisfactory SCM (Fig. 2). Preoperative parameters to be evaluated include breast volume, degree of excess skin, nipple-areola complex (NAC) size and position, and skin elasticity.
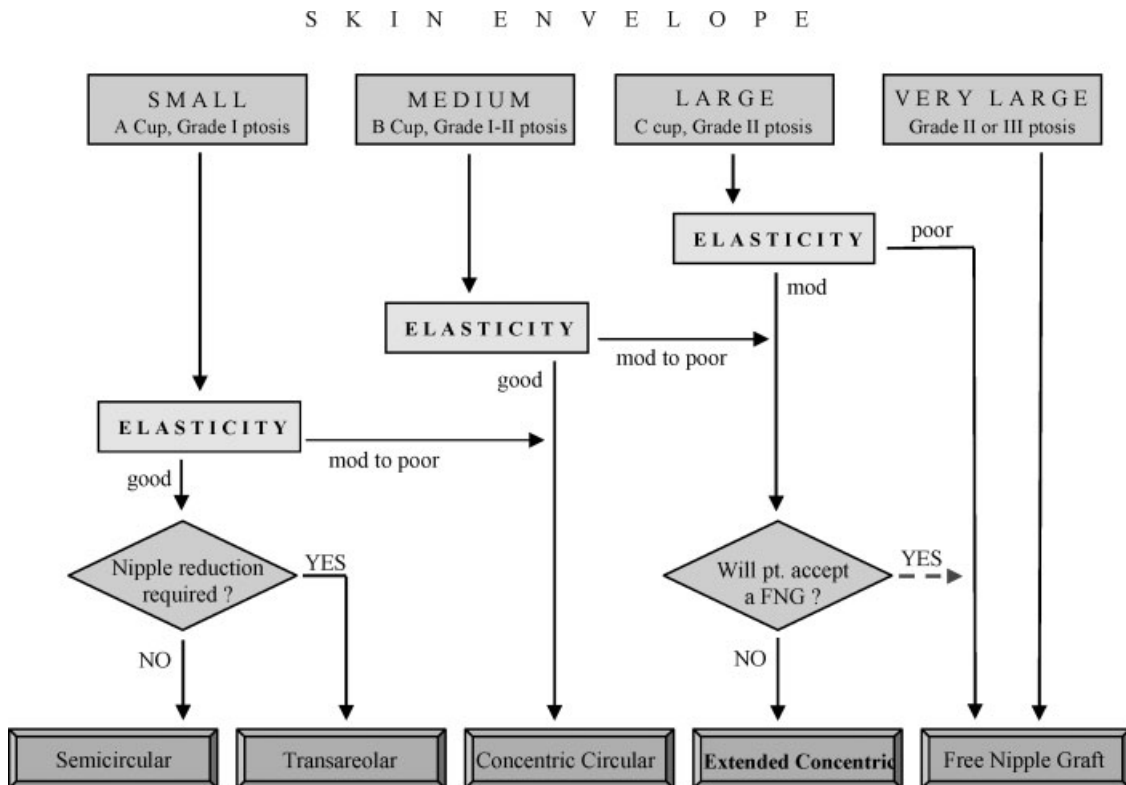

Figure 2 Algorithm for choosing appropriate subcutaneous mastectomy technique.

Regardless of the technique, it is extremely important 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. Postoperatively, a circumferential elastic bandage is placed around the chest wall and maintained for a total of 4 to 6 weeks.

Techniques

The semicircular technique (Fig. 3) is essentially the same procedure as that described by Webster in 1946[7] for gynecomastia. It is useful for individuals with smaller breasts and elastic skin. A sufficient amount of glandular tissue should be left in situ beneath the NAC 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. The major drawback is the small window through which to work,

making excision of breast tissue and hemostasis more challenging.

In cases of smaller breasts with large prominent nipples, the transareolar technique (Fig. 4) is used. This is similar to the procedure described by Pitanguy in 1966[8] and 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 (Fig. 5) is similar to that described by Davidson in 1979.[9] It is used for breasts with a medium-sized skin envelope (B cup), or in the case of smaller breasts with poor skin elasticity. The resulting scar will be confined to the circumference of the areola. The concentric incision can be drawn as a circle or ellipse, enabling deepithelialization of a calculated amount of skin in the vertical or horizontal direction.[4,5] Access is gained via an incision in the inferior aspect of the outer circle leaving a wide pedicle for the NAC. A purse-string suture is placed and set to the desired areolar diameter (usually 25–30 mm).
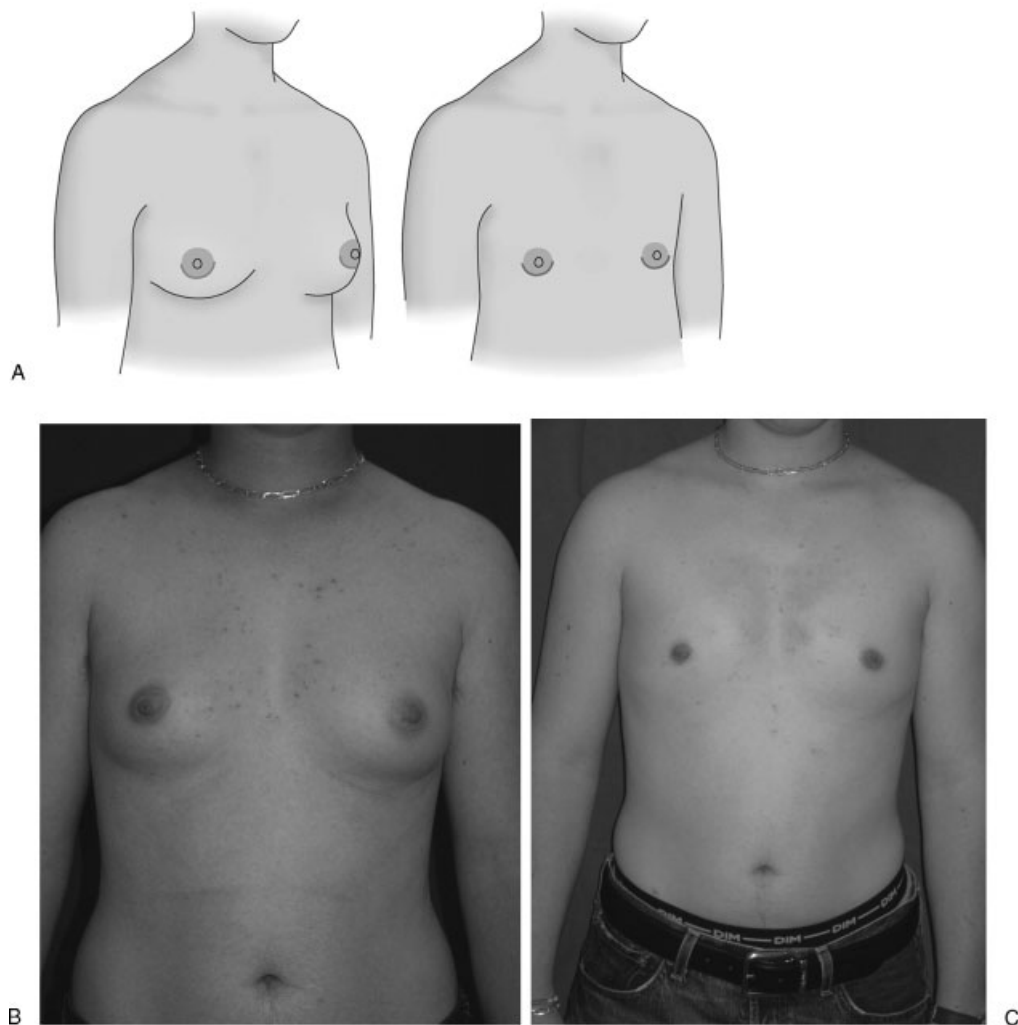

Figure 3 Semicircular technique. (A) Incisions and scar; (B) preoperative; (C) postoperative.
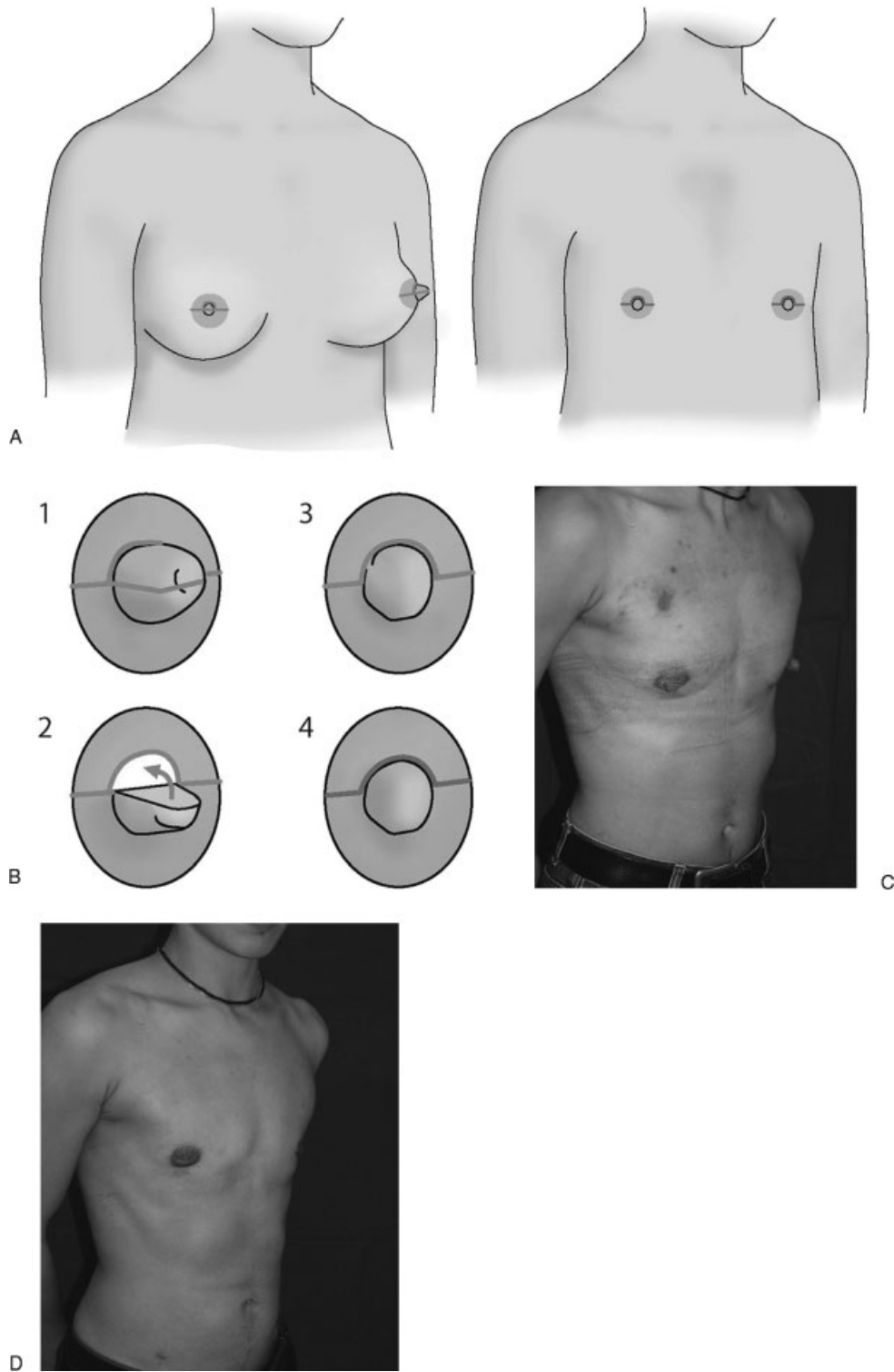
Figure 4 Transareolar technique. (A,B) Incisions and scar; (C) preoperative; (D) postoperative.

The advantage of this technique is that it allows for reduction and/or repositioning of the areola, where required, and for the removal of excess skin.

The extended concentric circular technique (Fig. 6) 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 large differences between the inner and outer circles. The resulting scars will be around the areola, with horizontal extensions onto the breast skin, depending on the degree of excess skin.

Figure 5 Concentric circular technique. (A) incisions; (B) preoperative; (C) postoperative.

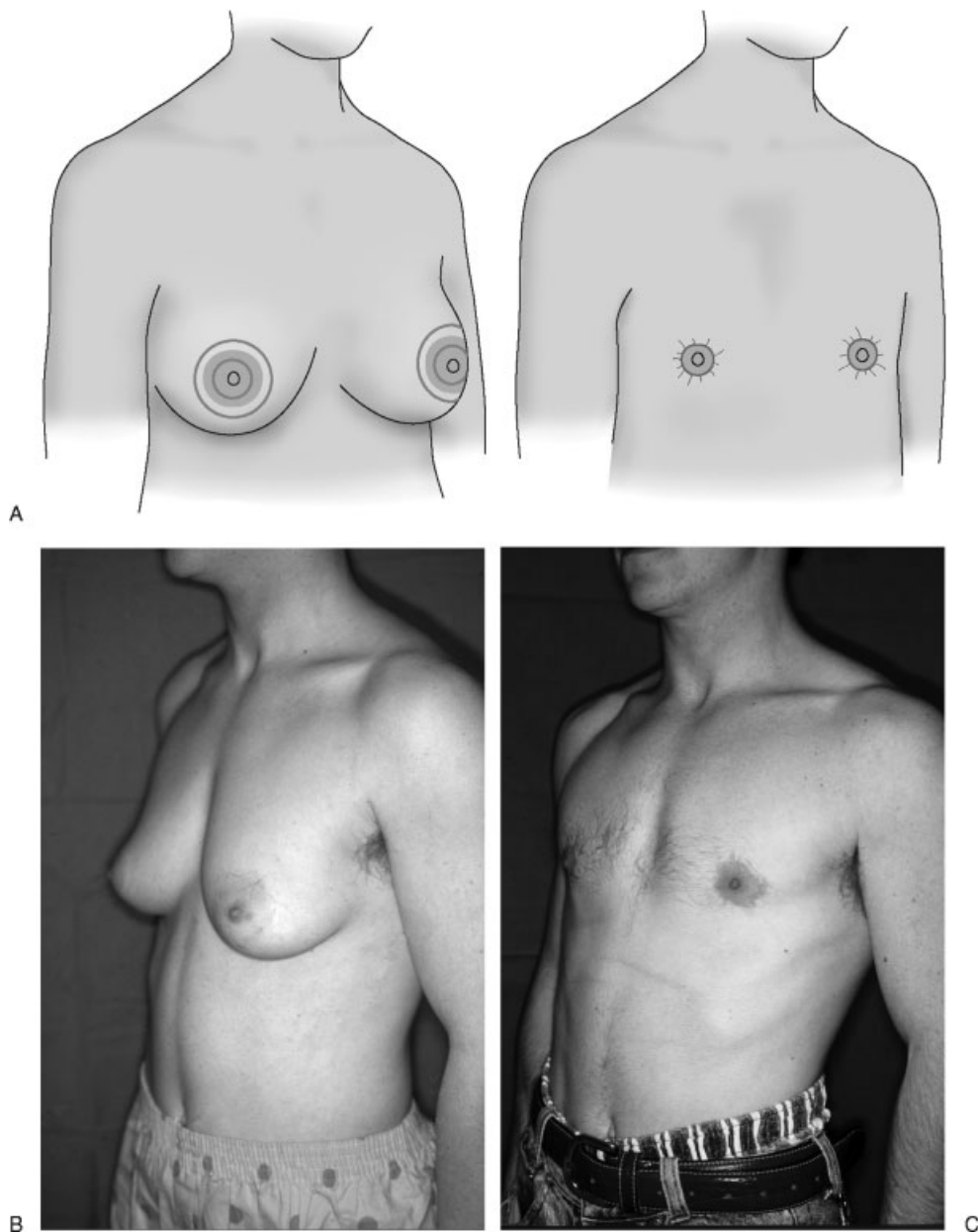The free nipple graft technique (Fig. 7) has been proposed by several authors for patients with large and ptotic breasts.[2,3,10–12] It consists of harvesting the NAC as a full-thickness skin graft; amputating the breast; and grafting the NAC onto its new location on the chest wall. Our preference is to place the incision horizontally 1 to 2 cm above the inframammary fold, and then to move upwards laterally below the lateral border of the pectoralis major muscle. The placement of the NAC usually corresponds to the 4th or 5th intercostal space. Clinical judgment is most important, however, and we always sit the patient up intraoperatively to check final nipple position. 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. The disadvantages are the long residual scars, NAC pigmentary and sensory changes, and the possibility of incomplete graft take.

Complications

Postoperative complications include hematoma (most frequent, despite drains and compression bandages), (partial) nipple necrosis, and abscess formation. This underscores the importance of achieving good hemostasis intraoperatively. Smaller hematomas and seromas can be evacuated through puncture, but for larger collections surgical evacuation is required.

Another not infrequent complication consists of skin slough of the NAC, which can be left to heal by
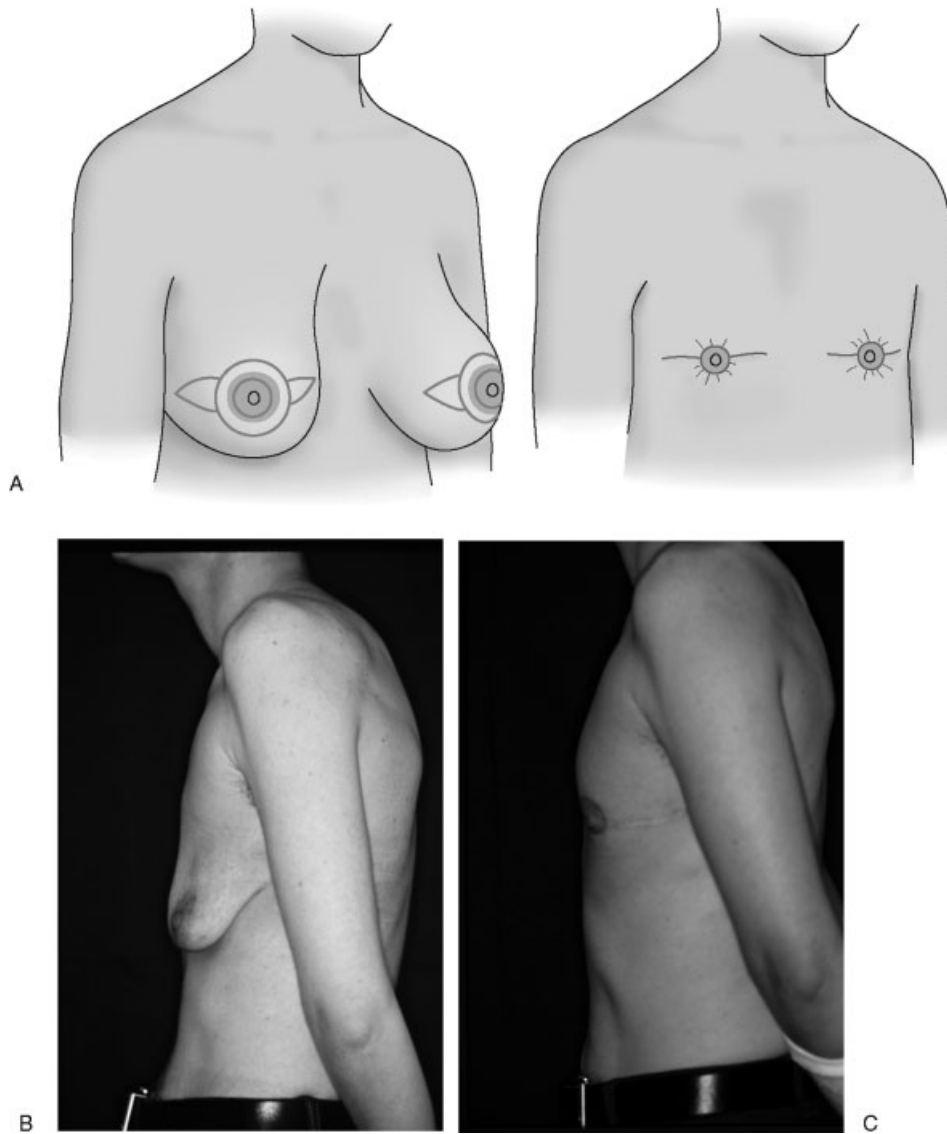
Figure 6 Extended concentric circular technique. (A) Incisions and scar; (B) preoperative preoperative; (C) postoperative.

conservative means. The exceptional cases of partial or total nipple necrosis may require a secondary nipple reconstruction. Even in the patients without complications, ~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.[13] Tattoo of the areola may be performed for depigmentation.

Conclusion
The recommendations of the authors are summarized in their algorithm (Fig. 2), which clearly demonstrates that a larger skin envelope and a less elastic skin will require progressively a longer-incision technique. The FTM transsexual patients are rightfully becoming a patient population that is better informed and more demanding as to the aesthetic outcomes.

Finally, it is important to note that there have been reports of breast cancer after bilateral SCM in this population[14–16] because in most patients the preserved NAC and the always incomplete glandular resection leave behind tissue at risk of malignant transformation.

PHALLOPLASTY

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 have sexual intercourse like a natural male, in a one-stage procedure.[17,18] The reconstructive procedure should also provide a normal scrotum, be predictably reproducible
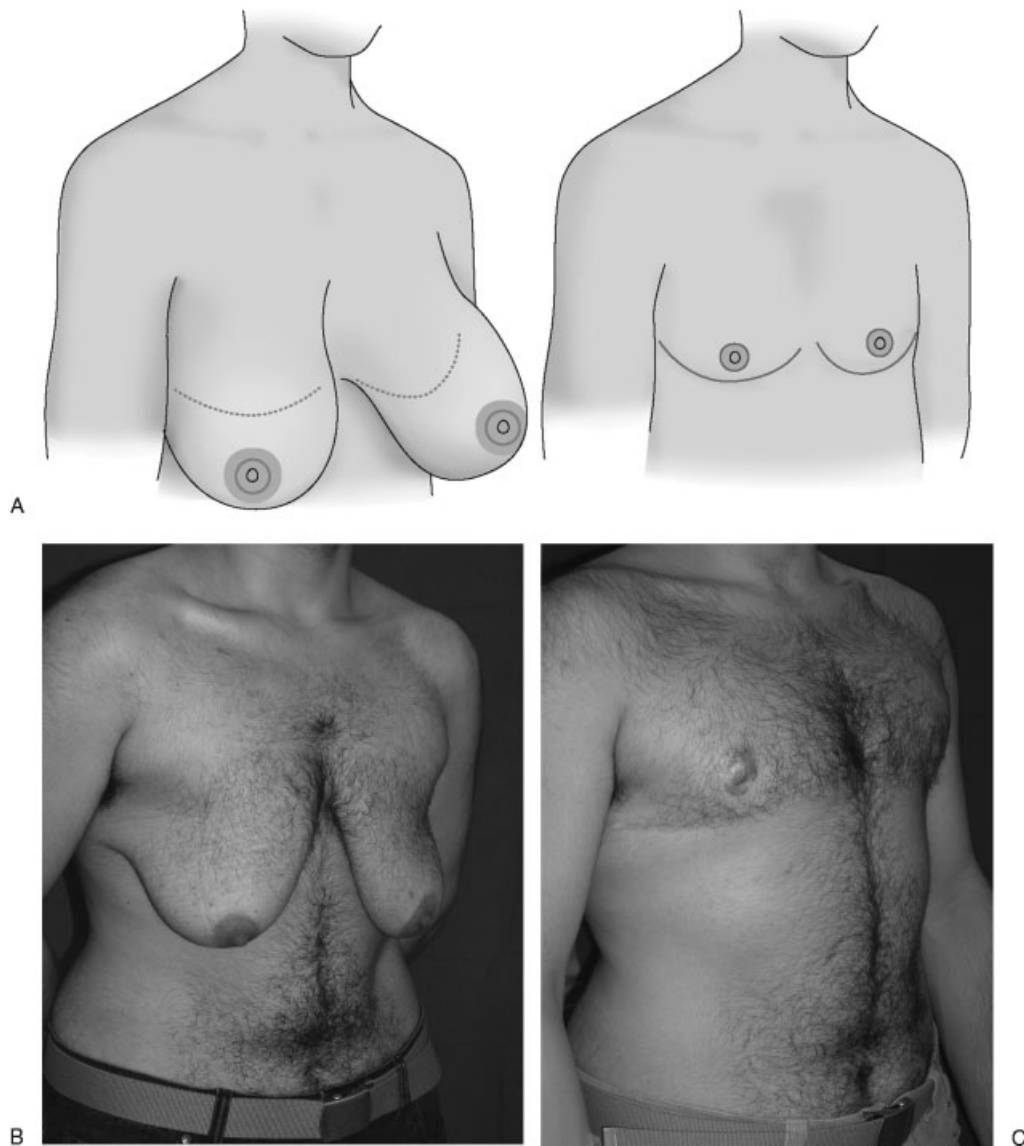
Figure 7 Free nipple graft technique. (A) Incisions and scar; (B) preoperative; (C) postoperative.

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 is universally considered the gold standard in penile reconstruction.[17,19–28]

In the largest series to date (almost 300 patients), Monstrey et al[29] 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.

Technique

For the genitoperineal transformation (vaginectomy, urethral reconstruction, scrotoplasty, phalloplasty), two surgical teams operate at the same time with the patient first placed in a gynecological (lithotomy) position. In the perineal area, a urologist may perform a vaginectomy, and lengthen the urethra with mucosa between the minor labiae. The vaginectomy is a mucosal colpectomy in which the mucosal lining of the vaginal cavity is removed. After excision, a pelvic floor reconstruction is always performed to prevent possible diseases such as cystocele and rectocele. 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 scrotum.

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 (Fig. 8A). This is commonly performed on the

Figure 8 (A–D) Phallic reconstruction with the radial forearm flap: creation of a tube (urethra) within a tube (penis).

ulnar aspect of the skin island. A small skin flap and a skin graft are used to create a corona and simulate the glans of the penis (Fig. 8B).

Once the urethra is lengthened and the acceptor (recipient) vessels are dissected in the groin area, the patient is put into a supine position. The free flap can be transferred to the pubic area after the urethral anastomosis: the radial artery is microsurgically connected to the common femoral artery in an end-to-side fashion and the venous anastomosis is performed between the cephalic vein and the greater saphenous vein (Fig. 8C). One forearm nerve is connected to the ilioinguinal nerve for protective sensation and the other nerve of the arm is anastomosed to one of the dorsal clitoral nerves for erogenous sensation. The clitoris is usually denuded and buried underneath the penis, thus keeping the possibility to be stimulated during sexual intercourse with the neophallus.

In the first 50 patients of this series, the defect on the forearm was covered with full-thickness skin grafts taken from the groin area. In subsequent patients, the defect was covered with split-thickness

skin grafts harvested from the medial and anterior thigh (Fig. 8D).

All patients received a suprapubic urinary diversion postoperatively.

The patients remain in bed during a one-week postoperative period, after which the transurethral catheter is removed. At that time, the suprapubic catheter was clamped, and voiding was begun. Effective voiding might not be observed for several days. Before removal of the suprapubic catheter, a cystography with voiding urethrography was performed.

The average hospital stay for the phalloplasty procedure was 2½ weeks.

Tattooing of the glans should be performed after a 2- to 3-month period, before sensation returns to the penis.

Implantation of the testicular prostheses should be performed after 6 months, but it is typically done in combination with the implantation of a penile erection prosthesis. Before these procedures are undertaken, sensation must be returned to the tip of the penis. This usually does not occur for at least a year.

The Ideal Goals of Penile Reconstruction in FTM Surgery

What can be achieved with this radial forearm flap technique as to the ideal requisites for penile reconstruction?

A ONE-STAGE PROCEDURE

In 1993, Hage[20] stated that a complete penile reconstruction with erection prosthesis never can be performed in one single operation. Monstrey et al,[29] early in their series and to reduce the number of surgeries, performed a (sort of) all-in-one procedure that included a SCM and a complete genitoperineal transformation. However, later in their series they performed the SCM first most often in combination with a total hysterectomy and ovariectomy.

The reason for this change in protocol was that lengthy operations (> 8 hours) resulted in considerable blood loss and increased operative risk.[30] Moreover, an aesthetic SCM is not to be considered as an easy operation and should not be performed "quickly" before the major phalloplasty operation.

AN AESTHETIC PHALLUS

Phallic construction has become predictable enough to refine its aesthetic goals, which includes the use of a technique that can be replicated with minimal complications. In this respect, the radial forearm flap has several advantages: the flap is thin and pliable allowing the construction of a normal sized, tube-within-a-tube penis; the flap is easy to dissect and is predictably well vascularized making it safe to perform an (aesthetic) glansplasty at the distal end of the flap. The final cosmetic outcome of a radial forearm phalloplasty 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 (Fig. 9A-C).

The potential aesthetic drawbacks of the radial forearm flap are the need for a rigidity prosthesis and possibly some volume loss over time.

TACTILE AND EROGENOUS SENSATION

Of the various flaps used for penile reconstruction, the radial forearm flap has the greatest sensitivity.[1] Selvaggi and Monstrey et al. always connect one antebrachial nerve to the ilioinguinal nerve for protective sensation and the other forearm nerve with one dorsal clitoral nerve. The denuded clitoris was always placed directly below the phallic shaft. Later manipulation of the neophallus allows for stimulation of the still-innervated clitoris. After one year, all patients had regained tactile sensitivity in their penis, which is an absolute requirement for safe insertion of an erection prosthesis.[31]

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).[32]

VOIDING WHILE STANDING

For biological males as well as for FTM transsexuals undergoing a phalloplasty, the ability to void while standing is a high priority.[33] Unfortunately, the reported incidences of urological complications, such as urethrocutaneous fistulas, stenoses, strictures, and hairy urethras are extremely high in all series of phalloplasties, as high as 80%.[34] For this reason, certain (well-intentioned) surgeons have even stopped reconstructing a complete neo-urethra.[35,36]

In their series of radial forearm phalloplasties, Hoebeke and Monstrey still reported a urological complication rate of 41% (119/287), but the majority of these early fistulas closed spontaneously and ultimately *all* patients were able to void through the newly reconstructed penis.[37] Because it is unknown how the new urethra—a 16-cm skin tube—will affect bladder function in the long term, lifelong urologic follow-up was strongly recommended for all these patients.

MINIMAL MORBIDITY

Complications following phalloplasty include the general complications attendant to any surgical intervention such as minor wound healing problems in the groin area or a few patients with a (minor) pulmonary embolism despite adequate prevention (interrupting hormonal therapy, fractioned heparin subcutaneously, elastic stockings). A vaginectomy is usually considered a particularly difficult operation with a high risk of postoperative bleeding, but in their series no major bleedings were seen.[30] Two early patients displayed symptoms of nerve compression in the lower leg, but after reducing the length of the gynecological positioning to under 2 hours, this complication never occurred again. Apart from the urinary fistulas and/or stenoses, most complications of the radial forearm phalloplasty are related to the free tissue transfer. The total flap failure in their series was very low (< 1%, 2/287) despite a somewhat higher anastomotic revision rate (12% or 34/287). About 7 (3%) 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.

With smoking being a significant risk factor, under our current policy, we no longer operate on patients who fail to quit smoking one year prior to their surgery.

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

Figure 9   (A–C) Late postoperative results of radial forearm phalloplasties.

(Fig. 10). Selvaggi et al conducted a long-term follow-up study[38] of 125 radial forearm phalloplasties to assess the degree of functional loss and aesthetic impairment after harvesting such a large forearm flap. An increased donor site morbidity was expected, but the early and late complications did not differ from the rates reported in the literature for the smaller flaps as used in head and neck reconstruction.[38] No major or long-term problems (such as functional limitation, nerve injury, chronic pain/edema, or cold intolerance) were identified. Finally, with regard to the aesthetic outcome of the donor site, they found that the patients were very accepting of the donor site scar, viewing it as a worthwhile trade-off for the

creation of a phallus (Fig. 10).[38] Suprafascial flap dissection, full thickness skin grafts, and the use of dermal substitutes may contribute to a better forearm scar.

NORMAL SCROTUM

For the FTM patient, the goal of creating natural-appearing genitals also applies to the scrotum. As the labia majora are the embryological counterpart of the scrotum, many previous scrotoplasty techniques left the hair-bearing labia majora in situ, with midline closure and prosthetic implant filling, or brought the scrotum in front of the legs using a V-Y plasty. These techniques were aesthetically unappealing and reminiscent of the
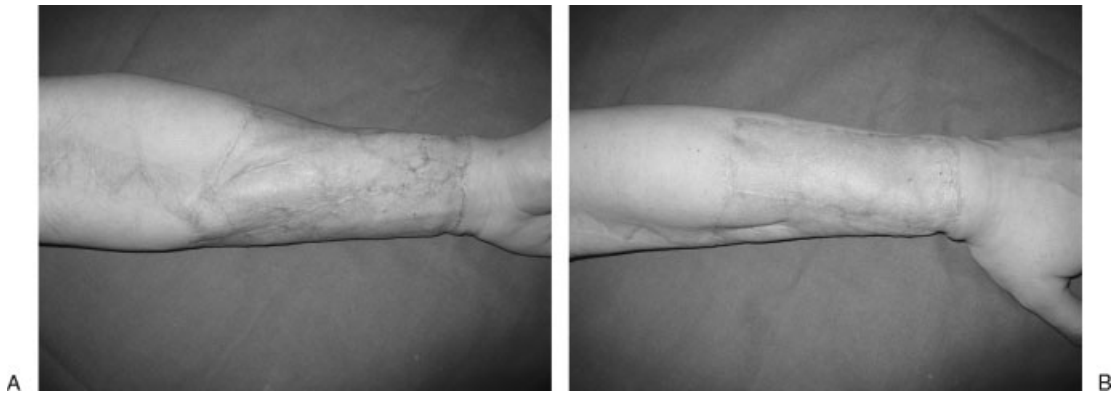
Figure 10   (A,B) Aspect of the donor site after a phalloplasty with a radial forearm flap.

female genitalia. Selvaggi in 2009 reported on a novel scrotoplasty technique, which combines a V-Y plasty with a 90-degree turning of the labial flaps resulting in an anterior transposition of labial skin (Fig. 11). The excellent aesthetic outcome 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.[39]

SEXUAL INTERCOURSE

In a radial forearm phalloplasty, the insertion of erection prosthesis is required to engage in sexual intercourse. In the past, attempts have been made to use bone or cartilage, but no good long-term results are described. The rigid and semirigid prostheses seem to have a high perforation rate and therefore were never used in our patients. Hoebeke, in the largest series to date on erection prostheses after penile reconstruction, only used the hydraulic systems available for impotent men. A recent long-term follow-up study showed an explan-tation rate of 44% in 130 patients, mainly due to malpositioning, technical failure, or infection. Still, more than 80% of the patients were able to have normal sexual intercourse with penetration.[37] In another study, it was demonstrated that patients with an erection prosthesis were more able to attain their sexual expectations than those without prosthesis (Fig. 12).[32]

A major concern regarding erectile prostheses is long-term follow-up. These devices were developed for impotent (older) men who have a shorter life expectancy and who are sexually less active than the mostly younger FTM patients.

Alternative Phalloplasty Techniques

METAIDOIOPLASTY

A metoidioplasty uses the (hypertrophied) clitoris to reconstruct the microphallus in a way comparable to the correction of chordee and lengthening of a urethra in

Figure 11   Reconstruction of a lateral looking scrotum with two transposition flaps: (A) before and (B) after implantation of testicular prostheses.

Figure 12   (A,B) Phalloplasty after implantation of an erection prosthesis.

cases of severe hypospadias. Eichner[40] prefers to call this intervention "the clitoris penoid." In metoidioplasty, the clitoral hood is lifted and the suspensory ligament of the clitoris is detached from the pubic bone, allowing the clitoris to extend out further. An embryonic urethral plate is divided from the underside of the clitoris to permit outward extension and a visible erection. Then the urethra is advanced to the tip of the new penis. The technique is very similar to the reconstruction of the horizontal part of the urethra in a normal phalloplasty procedure. During the same procedure, a scrotal reconstruction, with a transposition flap of the labia majora (as previously described) is performed combined with a vaginectomy.

Figure 13   Results of a metoidioplasty procedure.

Figure 14 Penile reconstruction with a pedicled anterolateral thigh flap. (A) Preoperative and (B) postoperative results.

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 (Fig. 13).

The major advantage of metoidioplasty is the complete lack of scarring outside the genital area. Another advantage is that its cost is substantially lower than that of phalloplasty. Complications of this procedure also include urethral obstruction and/or urethral fistula.

It is always possible to perform a regular phalloplasty (e.g., with a radial forearm flap) at a later stage, and with substantially less risk of complications and operation time.

FIBULA FLAP

There have been several reports on penile reconstruction with the fibular flap based on the peroneal artery and the peroneal vein.[27,41,42] It consists of a piece of fibula that is vascularized by its periosteal blood supply and connected through perforating (septal) vessels to an overlying skin island at the lateral site of the lower leg. 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.[42]

NEW SURGICAL DEVELOPMENTS: THE PERFORATOR FLAPS

Perforator flaps 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 anterolateral thigh (ALT) flap. This flap is a skin flap based on a perforator from the descending branch of the lateral circumflex femoral artery, which is a branch from the femoral artery. It can be used both as a free flap[43] and as a pedicled flap[44] then avoiding the problems related to microsurgical free flap transfer. The problem related to this flap is the (usually) thick layer of subcutaneous fat making it difficult to reconstruct the urethra as a vascularized tube within a tube. This flap might be more indicated for phallic reconstruction in the so-called boys without a penis, like in cases of vesical exstrophy (Fig. 14). However, in the future, this flap may become an interesting alternative to the radial forearm flap, particularly as a pedicled flap. If a solution could be found for a well-vascularized urethra, use of the ALT flap 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. Other perforator flaps include the thoracodorsal perforator artery flap (TAP) and the deep inferior epigastric perforator artery flap (DIEP). The latter might be an especially good solution for FTM patients who have been pregnant in the past. Using the perforator flap as a pedicled flap can be very attractive, both financially and technically.

CONCLUSION

The Importance of a Multidisciplinary Approach

Gender reassignment, particularly reassignment surgery, requires close cooperation between the different surgical specialties. In phalloplasty, the collaboration between the plastic surgeon, the urologist, and the gynecologist is essential.[45] The actual penile reconstruction is typically performed by the plastic and reconstructive surgeon, and the contribution of the gynecologist, who performs a hysterectomy and a BSO (preferably through a minimal endoscopic access in combination with SCM), should not be underestimated.

However, in the long term, the urologist's role may be the most important for patients who have undergone

penile reconstruction, especially because the complication rate is rather high, particularly with regard to the number of urinary fistulas and urinary stenoses. The urologist also reconstructs the fixed part of the urethra. He or she is likely the best choice for implantation and follow-up of the penile and/or testicular prostheses. They must also address later sequelae, including stone formation. Moreover, the surgical complexity of adding an elongated conduit (skin-tube urethra) to a biological female bladder, and the long-term effects of evacuating urine through this skin tube, demand lifelong urological follow-up.

Therefore, professionals who unite to create a gender reassignment program should be aware of the necessity of a strong alliance between the plastic surgeon, the urologist, mental health professional 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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