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ORIGINAL ARTICLE / ARTICLE ORIGINAL

Genital reassignment surgery for transsexual people

Chirurgie de réassignation sexuelle pour les transsexuels

Cirugía de reasignación sexual para transexuales

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KEYWORDS
Genital reassignment;
Phalloplasty;
Vaginal plasty;
Gender identity disorders;
Transsexualism

Summary Transsexualism is defined as a persistent and strong cross-gender identification, combined with the patients persistent discomfort with his or her sex and a sense of inappropriateness in the gender role of that sex (Diagnostic and Statistical Manual of Mental Disorders, revision 4, [DSM-IV-TR]). This disturbance causes clinical distress or impairment in social, occupational or other important areas of functioning. The specifically trained mental health professional is obliged to find out, if the patient fulfills all criteria of an irreversible gender transposition and if he or she will benefit from medical (hormonal and surgical) sex reassignment treatment. After absolving 12 months of real life-experience and after at least six months of continuous hormonal treatment, the indication for surgical sex-reassignment may be given. Genital sex-reassignment in male-to-female transsexuals include vaginal-plasty, preferably by inversion of penoscrotal skin flaps, clitoral-plasty and vulvoplasty. Operative procedures may be performed in one or two sessions. In female-to-male subjects, no operative standards are available up to now. During the last decade, neophallus creation from a sensate free forearm flap has emerged as the most promising approach for those patients, who want to have a neophallus reconstruction. There exist other alternative techniques such as metoidoioplasty or neophallus reconstruction from regional flaps, but they are also accompanied by multiple possible complications and reinterventions. Best results have to be expected, when multidisciplinary teams of plastic surgeons, urologist, gynecologist and experts in sexual medicine in large volume-centers are involved in indication and performance of operative procedures.

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MOTS CLÉS
Réassignation sexuelle ;
Phalloplastie ;
Plastie vaginale ;
Troubles de l'identité du genre ;
Transsexualisme

Résumé Le transsexualisme se définit comme une identification à l'autre sexe forte et persistante, associée à une gêne permanente du patient pour son sexe et un sentiment d'inadéquation vis-à-vis du rôle de genre lié à ce sexe (*Manuel diagnostique et statistique des troubles mentaux, quatrième édition*, [DSM-IV-TR]). Ce trouble est à l'origine d'une détresse ou d'une altération clinique dans les domaines sociaux, professionnels et d'autres domaines fonctionnels importants. Le professionnel de santé mentale spécifiquement formé doit déterminer si le/la patient(e) remplit tous les critères pour une transition de genre irréversible et si il/elle est en mesure de tirer avantage d'un traitement médical (hormonal et chirurgical) de changement de genre. Après 12 mois d'expérience en situation réelle et au moins six mois de traitement hormonal continu, l'indication d'un changement de sexe peut être posée. Dans le cas du changement d'homme vers femme, la réhabilitation génitale inclut une plastie vaginale, de préférence par inversion de lambeaux cutanés pénoscrotaux, une plastie clitoridienne et une plastie vulvaire. Les interventions peuvent être effectuées en un ou deux temps. Pour les sujets de femme vers homme, il n'existe pas encore de normes chirurgicales. Au cours de la dernière décennie, l'approche qui a émergé comme la plus prometteuse pour les patients qui souhaitent disposer de cette reconstruction, est la création d'un néophallus à partir d'un lambeau libre de l'avant-bras. Il existe d'autres techniques alternatives telles que la metoidioplastie ou la reconstruction d'un néophallus par lambeaux régionaux, mais elles s'accompagnent de multiples complications et reprises chirurgicales. On peut attendre de meilleurs résultats lorsque des équipes multidisciplinaires de chirurgiens plastiques, d'urologues, de gynécologues et d'experts en médecine sexuelle travaillant dans des centres à haut volume de patients sont impliqués dans les indications et les interventions.

PALABRAS CLAVE
Transición genital;
Faloplastia;
Plastia vaginal;
Trastornos de identidad de género;
Transexualidad

Resumen La transexualidad se define como una identificación al otro sexo fuerte y persistente, combinado a la molestia permanente del paciente provocada por su sexo y un sentimiento de inadecuación en el papel de género vinculado a dicho sexo (*Manual diagnóstico y estadístico de los trastornos mentales, cuarta edición*, [DSM-IV-TR]). Este trastorno induce una angustia clínica o una forma de hándicap a nivel social, profesional y funcional, El profesional de salud mental específicamente formado debe determinar si el/la paciente reúne todos los criterios para una transición de género irreversible y si está en condiciones de beneficiarse de un tratamiento médico (hormonal y quirúrgico) de cambio de género. Tras 12 meses de experiencia en situación real y al menos 6 meses de tratamiento hormonal contínuo, se puede indicar un cambio de sexo. Si se trata de un cambio sexual de hombre a mujer, la rehabilitación genital incluye una plastia vaginal, preferentemente por inversión de colgajos cutáneos penoescrotales, una plastia clitoridiana y una plastia vulvar. Las intervenciones pueden efectuarse en una o dos sesiones. En el caso de un cambio sexual de mujer a hombre, todavía no existen normas quirúrgicas. Desde hace una década, la creación de un neopene a partir de un colgajo libre de antebrazo parece ser el enfoque más prometedor para los pacientes que desean recurrir a esta reconstrucción. Existen otras técnicas alternativas tales como la reconstrucción de un neopene con colgajos regionales, pero suelen ir acompañadas de múltiples complicaciones y nuevas intervenciones quirúrgicas. Se pueden alcanzar mejores resultados cuando existen equipos multidisciplinares de cirujanos plásticos, urólogos, ginecólogos y expertos en medicina sexual que trabajan en centros con un gran numéro de pacientes y que están implicados en las indicaciones y en las intervenciones.

Version abrégée

Le concept de changement de sexe médicalisé repose sur la nécessité de remplir les critères requis pour le traitement chirurgical conformément aux recommandations de la World Professional Association for Transgender Health (WPATH), qui sont périodiquement mises à jour et publiées. La chirurgie de réassignation sexuelle génitale chez les patients homme-vers-femme comprend une vaginoplastie — généralement à partir de lambeaux cutanés pénoscrotaux — une clitoroplastie, une vulvoplastie et une orchidectomie bilatérale. L'intervention peut se faire en une ou deux sessions. Plusieurs articles de qualité sont disponibles dans la littérature, ce qui devrait rendre l'intervention reproductible et standardisable. Des articles publiés récemment font mention de plusieurs techniques de modification du lambeau cutané pénoscrotal utilisé comme fourreau vaginal. Chez les patients qui ont un pénis court et/ou une circoncision radicale, la longueur de l'inversion de la peau pénienne risque d'être insuffisante pour permettre un dôme néovaginal. Dans de tels cas, il est possible de faciliter l'élongation du tube cutané pénien par séparation de toute la peau du scrotum préalablement rendue plus fine et épilée. Ces interventions peuvent également avoir lieu au cours d'un deuxième temps en même temps que d'autres améliorations de la vulvoplastie.

Les patients transsexuels qui ont un néovagin de fourreau cutané doivent impérativement procéder des dilatations postopératoires quotidiennes. Il existe un dispositif pneumatique intéressant en silicone doux pourvu d'une valve de remplissage individuel utilisable dans les six à huit semaines postopératoires, remplacé par un dispositif plus ferme après cicatrisation des lésions afin d'éviter la formation de cicatrices de rétraction. Il est indispensable d'informer les patients de ce que la vaginoplastie nécessitera cette pratique d'autodilatation régulière pour le restant de leur vie. Les grands centres spécialisés qui traitent un grand nombre de patients ne rapportent que 10 % de chirurgie de reprise chirurgicale pour rétraction de la cavité néovaginale.

Il est globalement convenu que l'intervention doit inclure une clitoroplastie grâce à laquelle le patient dispose d'un organe érotiquement sensible, qui peut même lui permettre d'atteindre l'orgasme. La création esthétique d'un vestibule vaginal et d'un prépuce clitoridien constitue une intervention très difficile. On ne trouve pas dans la littérature d'articles consensuels sur la planification de ces interventions. Dans notre établissement, nous préférons retarder ces étapes de reconstruction dans un second temps prévu au moins quatre à six mois après la première intervention. Toutefois, d'autres auteurs rapportent un objectif de réalisation d'un complexe clitoro-vestibulo-labial esthétique dès l'intervention de réassignation génitale de première intention. Plus de 80 % des patients transsexuels homme-vers-femmes opérés mentionnent une sensibilité érogène du néoclitoris après clitoroplastie. Dans une série récente de 390 patients opérés selon les techniques chirurgicales recommandées, le taux de reprise chirurgicale a été de 22 %, principalement pour une chirugie correctrice du complexe introïtus et clitorolabial.

À l'inverse, il n'existe pas de standards chirurgicaux pour les sujets femmes-vers-hommes, contrairement à la réassignation génitale chez les patients hommes-vers-femmes. La réduction mammaire et l'hystérectomie ainsi que l'ovariectomie sont des interventions courantes en chirurgie gynécologique et plastique. Elles peuvent être effectuées soit en gestes indépendants avant la réassignation génitale, soit en combinaison avec la dernière étape chirurgicale.

Dans la littérature récente, des auteurs ont publié sur une approche prometteuse de création de néophallus à partir d'un lambeau libre sensibilisé de l'avant-bras pour les patients qui souhaitent disposer d'un néophallus. De toute évidence, il existe des interventions moins invasives telles que la metoidioplastie ou la reconstruction néopénienne au moyen de lambeaux régionaux, mais elles s'accompagnent de nombreuses complications et de possibilité de reprises chirurgicales. D'un point de vue cosmétique et fonctionnel, les lambeaux libres d'avant-bras par microchirurgie donnent de meilleurs résultats et peuvent être effectués en une seule session par une équipe interdisciplinaire de chirurgiens plastiques et d'urologues. L'intervention comprend une vaginectomie et le prélèvement d'un greffon cutané complet sur une zone donneuse de l'avant-bras. Il est essentiel de préparer à la coaptation plusieurs vaisseaux receveurs tels que les vaisseaux épigastriques et plusieurs nerfs, de préférence le nerf dorsal du clitoris. Ce type d'intervention ne doit être entreprise que par un chirurgien expérimenté en microchirurgie utilisant un microscope chirurgical.

La complexité de ces interventions induit de nombreuses complications, elles doivent donc être expliquées en détails au patient. Les grands centres rapportent moins de 5 % de perte partielle ou totale du lambeau. Les complications urétrales — telles que fistules et sténoses — sont les principales causes de reprise chez environ 50 à 60 % des patients. Il faut envisager l'implantation d'une prothèse pénienne ou testiculaire au moins six mois après cicatrisation complète de l'urètre et retour de la sensibilité tactile du néopénis. Des prothèses hydrauliques ayant un revêtement en Dacron des cylindres, destiné à éviter la migration et l'érosion du dispositif, ont les résultats fonctionnels et esthétiques les plus prometteurs. Il faut expliquer aux patients que les complications liées à la chirurgie prothétique sont en général plus fréquentes qu'après une implantation de prothèse pénienne chez les hommes biologiques. Les premiers résultats de ces techniques montrent que plus de 80 % des patients sont en mesure d'atteindre un orgasme par simulation pénienne et d'avoir des rapports sexuels, sous réserve d'une bonne coaptation du nerf vulvaire ou clitoridien et des nerfs adéquats du lambeau de l'avant bras.

Même si l'on manque toujours de données de suivi à long terme concluantes sur la diversité des nouvelles techniques chirurgicales de reconstruction pénienne, les lambeaux libres d'avant bras transférés par microchirurgie suivis ensuite de l'implantation de dispositifs prothétiques hydrauliques à trois composants constituent l'approche la plus prometteuse pour la réassignation génitale des patients transsexuels femme-vers-homme.

Full version

Introduction and history

Transsexualism is defined as a strong and persistent cross-gender-identification with persistent discomfort for the patient with his or her sex in the sense of inappropriateness in the gender role of that sex (DSM-IV-TR). There are no specific laboratory or psychometric tests to confirm that a particular patient has an irreversible gender identity disorder. Ablative surgical procedures as orchiectomy or hysterectomy have long been performed for sex change purposes, before the term ''transsexual'' had been introduced into the scientific literature. It was as early as 1931 that a complete staged genital reassignment procedure in a male-to-female transsexual (MF-TS) has been published in a medical journal (Abraham, 1931). In 1966, Harry Benjamin brought genital sex-reassignment surgery on a scientific level by publishing his book ''The transsexual phenomenon''. Forteen years later, the first standards of care of the ''Harry Benjamin International Gender Dysphoria Association'' (HBIGDA) were published in 1979. The standards have been continuously updated and the last sixth version was published in 2001 (Meyer et al., 2001). Recently, the society has changed its name into ''World Professional Association for Transgender Health (WPATH)''.

These standards can be seen as an international interdisciplinary recommendation which should be brought into context with national forensic and medical recommendations for the individual patient.

The prevalence for gender identity disorders varies with survey methods and cultural as well as geographical differences between various countries. It has been reported as 1:2900 in Singapore and 1:36000 in Germany. Gender identity disorders seem to affect more biological males than females, sex-ratio in various reports is about 3:1 (Sohn and Bosinski, 2007). The actual standards of care of WPATH represent a professional consensus about the psychiatric, psychological, medical and surgical management of patients with gender identity disorders. They provide the requirement for diagnostic and therapeutic procedures as:

- diagnostic assessment;
- real life experience and psychotherapy;
- hormonal therapy;
- surgical therapy.

Preconditions for surgical treatment in transsexual patients

Surgical genital reassignment may be undertaken, if a patient has achieved 12 months of real life experience, living in the desired sex, has received at least six months of continuous hormonal treatment and has reached reasonable understanding of costs, length, likely complications and postsurgical rehabilitation requirements of surgical procedures. The readiness criteria for surgical treatment have to be approved and reconfirmed by two letters of recommendation by independent mental health professionals (Meyer et al., 2001).

It should be pointed out, that the mental health professionals, the surgeon and the patient share responsibility of the decision to undertake irreversible changes to the body.

The surgeon performing genital reconstruction should be board certified by a nationally known and reputable association. It should be an urologist, a gynecologist, plastic or general surgeon. He should also have competence in genital reconstructive techniques, attained by documented supervised training. His knowledge should include more than one of the surgical techniques for genital reconstruction.

While the WPATH recommendations for diagnostic evaluation and indications for treatment fulfill the prerequisits for international guidelines, operative details of genital sex reassignment surgery remain open to debate. Repeatedly standards of care — and CMI-reports on subtopics of this field have been published in several medical societies and journals, which have not been able to eliminate the lack of consensus on surgical details, especially in female-to-male transsexuals (FM-TS) genital reassignment.

Surgical reassignment in MF-TS

Non genital surgery in MF-TS transsexualism

It is not the option of this paper to cover all aspects of extragenital surgery as implantation of mammary prosthesis or cricothyropexy for voice augmentation or resection of the thyroid prominence as well as rhinoplasty to provide the patient with a more feminine profile. Timing of all these procedures in relationship to surgical genital reassignment is optional (Monstrey et al., 2001). It is prudent to postpone breast augmentation to several months after genital surgery in order to await the beneficial effect of castration on breast tissue proliferation.

Genital reassignment surgery in male to female transsexuals

The actual goals of genital gender reassignment surgery in MF-TS patients were resumed by Karim et al., 1996: ''The surgical aim of genital reassignment in MF-TS is to create a perineogenital complex as feminine in appearance and function as possible. The perineogenital area should be free of poorly healed areas, scars and neuromas. The neovagina should ideally be lined with moist, elastic and hairless epithelium. Its depth should be at least 10 cm and its diameter should be 30 mm''.

There is general consensus, that genital gender reassignment surgery in MF-TS patients should include the following steps (Karim et al., 1996; Selvaggi et al., 2005):

- bilateral ablatio testis with resection of the spermatic chord;
- amputation of the penis;
- neovaginal cavity with a sensitive lining;
- female urethral meatus;
- reconstruction of labia and clitoris.

Vaginal plasty in MF-TS patients

Five methods for the lining of the neovaginal cavity have been described in the recent literature (Selvaggi et al., 2005; Sohn and Bosinski, 2007):

- application of non genital skin grafts;
- penile skin graft;
- penile scrotal skin flaps;
- non genital skin flap;
- pedicled intestinal transplants.

From the recent literature it becomes obvious, that in all large volume-centers, penile scrotal skin flaps today are favoured by most authors (Monstrey et al., 2001; Karim et al., 1996; Selvaggi et al., 2005; Krege et al., 2001; Sohn and Bosinski, 2007).

Several modifications of penoscrotal skin flaps have recently been published, for example the inclusion of a pedicled and open urethral segment into the tube for diameter enlargement and better lubrication (Perovic et al., 2000). In case of a short penis or after radical circumcision the reduced length of the penile skin tube may be augmented by split skin grafts or full scrotal skin grafts after thinning and epilation (Krege et al., 2001).

Daily postoperative dilation of the neovagina is of utmost importance for the preservation of neovaginal length and diameter. A pneumatic soft silicone device with a valve for individual filling seems to be an attractive dilator for the first eight weeks after surgery (Mentor-Corporation®), which should be substituted by a more solid device after complete wound healing, in order to prevent contractile scar formation. Life-long regular self-dilation of the neovagina is essential to contain a sufficiently wide and long neovagina. Shrinkage of the neovagina with need for secondary

procedures occurs in around 10% in large volume-centers (Selvaggi et al., 2005; Krege et al., 2001; Sohn and Bosinski, 2007).

As secondary procedures pedicled intestinal transplants may appear attractive for reconstruction of the neovagina (Hage et al., 1995). Retention of mucus, introitus stenosis, persistent odor and colitis are further complications of this procedure. Alternatively free superficial meshgrafts of extragenital skin can be used for vaginal cavity lining (Sohn and Bosinski, 2007).

Clitoral-labio-plasty

Up to 1995, the creation of a sensible well-vascularized neoclitoris was not integral part of surgical standards in MF-TS reassignment surgery (Eicher, 1995).

Since then nearly all reports on MF-TS genital reassignment include clitoral plasty into the standard surgical procedure. The neoclitoris is derived from the glans penis with its intact neurovascular dorsal bundle in continuity, which has to be dissected completely from the corpora cavernosa for this purpose. Torsion- and pressure-free positioning of the bundle is essential in order to avoid postoperative necrosis of the neoclitoris. It is essential to resect both corpora cavernosa completely and to resect at least partially the corpus spongiosum in order to refine the vestibulum and introitus area and to avoid obstruction during intercourse due to arousal-induced swelling of erectile tissue (Selvaggi et al., 2005; Krege et al., 2001; Karim et al., 1995).

Esthetically acceptable labia majora should be formed from residual scrotal skin. In the majority of cases sufficient well-vascularized scrotal skin is available for labia majora and minora formation. The creation of an esthetically appealing posterior commissure is facilitated by preparing a small posterior base of the inverted Y-incision, advocated by Karim et al., 1995.

Strong tension on the abdominal pedicle of the penile skin flap used for inversion- vaginoplasty results in a gap of the labia minora ventrally. In order to correct this anterior dehiscence, a simultaneous infrapubic double Z-plasty may be performed (Meyer and Kesselring, 1980). On the other hand, these additional incisions may endanger penile skin blood supply and may result in hypertrophic scar formation (Krege et al., 2001; Karim et al., 1995). Consequently, it is wise to wait with these procedures until complete wound healing has occurred. In recent papers much effort has been invested by several surgical teams to improve the aspect and function of the clitoro-vestibulo-labial complex during primary genital reassignment procedures. It remains open to debate whether such detailed procedures should not be performed as a planned secondary operation after complete wound healing (Selvaggi et al., 2005; Krege et al., 2001; Sohn and Bosinski, 2007; Giraldo et al., 2004; Chokrungvaranont and Tiewtranon, 2004).

Postoperative follow-up studies

Pfäfflin published a comprehensive compilation of follow-up studies after sex reassignment surgery in 1992 (Pfäfflin and Junge, 1992). It should be kept in mind that, at that time, surgical techniques and functional as well as esthetic results were far behind the actual possibilities. A more actual analysis of this and other compilative reports by Hartmann and Becker, 2002 identified a negative postoperative outcome in about 15% of all operated patients. In general, it may be concluded that good surgical results have been identified as significant indicator for overall positive outcome. Considering the progress of surgical techniques achieved in the recent 15 years, it may be wise to search for follow-up studies comparing older and newer operative strategies. From single reports, it becomes obvious that satisfaction with vaginal depths and widths can be observed in around 75% of all operated patients. If the neurovascular bundle is preserved, an 80 to 87% clitoral orgasm rate can be achieved (Krege et al., 2001; Karim et al., 1995; Sohn and Bosinski; Selvaggi et al., 2007; Soli et al., 2008). Re-operation rates of more than 20% have to be expected, mostly due to corrective surgery of the introitus and the clitoral-labial-complex (Hage et al., 2000) (Fig. 1).

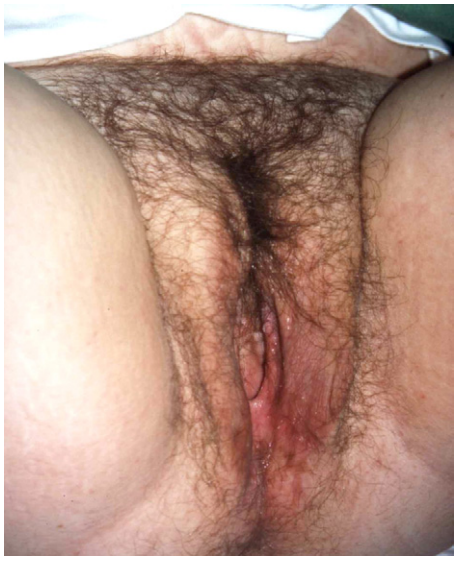

Figure 1 Genital aspect six months after. MF-TS genital reassignment.
Aspect genital six mois après réassignation sexuelle MvF.

Surgical reassignment in FM-TS

Breast reduction and hysterectomy, ovarectomy

Hysterectomy and ovarectomy should be performed as preliminary procedure to reconstructive genital reassignment in FM-TS patients. To include these procedures into reconstructive genital reassignment (''all in one'' procedures) may be more cost- and time-effective, but exposes the patient to an extended trauma, blood loss and anesthesia-time. Hysterectomy and ovarectomy may be performed by a transabdominal, transvaginal or laparoscopic approach. The gynaecologist, performing these procedures, should take care in preventing damage to abdominal wall vessels, which may be important as future recipient vessels during free flap reconstruction of the neopenis (inferior epigastric artery and vein).

Obtaining a male-chest configuration is of utmost importance for FM-TS patients, so that subcutaneous mastectomy

often is the first step of surgical reassignment, long before genital reassignment surgery. Breast reduction should precede other operative procedures and greatly facilitates real life test and adjustment to a male lifestyle. In patients with larger breasts, skin reduction is required and usually performed by circular periareolar excision and de epithelialization (Monstrey et al., 2001).

Metoidoioplasty

This complicated term describes surgical enlargement procedures of the clitoris with prolongation of the female urethra to the tip of the clitoris, enabling the patient to void in a standing position. The first description of this technique dates back to 1973 (Hage, 1996). The procedure should be undertaken after sufficient long-term testosterone treatment, stimulating the growth of the clitoris. Strengthening and lengthening of the clitoris is reached by release of the ventral clitoral chorda and ligaments. Vestibulum and labia minora are used to perform a urethroplasty to the tip of the clitoris. The rest of the vagina is completely excised and labia majora are reconstructed into a neoscrotum, mostly with implantation of testicle prosthesis subcutaneously (Perovic and Sjordjevic, 2003). Recently, long-term results of such procedures were analyzed in 70 patients (Hage and Van Turnhout, 2006). An average of 2.6 surgical procedures per patient was needed to complete genital reassignment and manage postoperative complications, primarily urinary fistula and stenosis. Seventeen of 70 patients additionally underwent later phalloplasties with free flaps for insufficient clitoral and urethral length.

Metoidoioplasty may be a method of choice in FM-TS patients who are in doubt about their wish for phalloplasty, but these patients should be informed, that complication rates and need for reoperations are considerable.

Phalloplasty and scrotal reconstruction in FM-TS patients

The first publication on successful phalloplasty dates back to 1936, using a tubed abdominal flap, transposed in multiple sessions (Bogoras, 1936). During the following decades, the search for the most effective method developed numerous techniques of abdominal flaps, scrotal skin flaps, tubed thigh flaps, gracilis musculocutanous flaps, groin flaps and iliac crest flaps.

On the other hand, the advances of microsurgery allowed free transplanted flaps, first used for penile reconstruction in 1984 (Vesely and Hage, 1999). Actually, a variety of more than 20 different free and pedicled flaps are published for the purpose of phalloplasty, which suggests, that there does not exist one single ideal technique, fulfilling all demands in neopenis formations.

The goals of modern phalloplasty were postulated by Gilbert shortly after the first publications of free radial forearm flaps for penile reconstruction (Gilbert and Winslow, 1987):

- a one-stage procedure that can be predictably preproduced;
- creation of a competent neourethra to allow voiding in standing position;
- return of tactile and erogenous sensibility;
- enough bulk to tolerate the insertion of a prosthetic device;
- a result that is aesthetically acceptable to the patient;
- minimal scarring or disfigurement;
- no functional loss in the donor area.

These goals are still valuable today and no standard-of-care guidelines exist for phalloplasty. The following chapter should describe only the most promising actual techniques publishes by large volume centers.

Regional flaps for phalloplasty

Bettochi et al. (2005) published long-time follow-up data from 84 FM-TS patients after pedicled pubic phalloplasty including urethral plasty to the tip of the neopenis. Before switching to a two-stage procedure, the stricture and fistula rate was 95%. Even after two-stage procedures, 50% of these patients developed urethral complications. The rate of complications can be lowered, if urethral plasty is only performed to the tip of the clitoris, which is left in place. Malleable or hydraulic prosthetic devices may be implanted if the prosthesis is secured by inclusion of rectus muscle into the penile shaft formation. Nevertheless, secondary operations are generally necessary for scrotal reconstruction and for thinning of the bulky neopenis (Exner, 1992).

Table 1 Steps of a possible one-session genital reassignment in FM-TS patients, using a free forearm flap (Monstrey et al., 2001; Sohn and Peek, 1999; Sohn and Bosinski, 2007).
Étapes de la réassignation sexuelle en un temps chez des patients transsexuels FtM, en utilisant un lambeau libre de l'avant-bras (Monstrey et al., 2001; Sohn et Peek, 1999; Sohn et Bosinski, 2007).

1. Hysterectomy, ovarectomy, vaginectomy (gynecologist)
2. Proximal urethroplasty, colpocleisis (urologist)
3. Preparation of recipient nerves and vessels (urologist)
4. Scrotoplasty (urologist)
5. Retrieval of a full skin graft from the groin (urologist)
6. Free forearm flap including distal neourethra by tube-in-a-tube formation (plastic surgeon)
7. Free flap transfer and microsurgical nerve and vessel coaption (plastic surgeon)
8. Urethral anastomosis (urologist)
9. Full skin graft coverage of forearm defect and primary closure of harvesting site in the groin (plastic surgeon)

Free flaps for phalloplasty in FM-TS patients

Recent publications on free flaps for phalloplasty focus on fibula and forearm as preferred donor sites. If no urologist is involved in the surgical gender team, plastic surgeons tend to include osseous segments as a substitute for erectile tissue into the flap. Nevertheless, a permanently rigid structure in the neopenis has to be considered as an imperfect solution. A further important shortcoming may be the resulting donor site morbidity with need for wearing a lower leg splint for at least six weeks after osteocutaneous fibula flaps and the potential for long term donor site problems with decreased power, suboptimal gate coordination and ankle stability. Recently, the use of a septocutaneous fibula free flap without fibula bone inclusion has been published and may evolve as an alternative to the widely accepted free forearm flap without bone inclusion (Dabernig et al., 2006).

In experienced hands, the free forearm flap has gained increasing acceptance over the last 25 years since its first description. In specialized centres where urologists and plastic reconstructive surgeons cooperate, the free forearm flap without urethral prelamination and without inclusion of osteous segments has become the first choice for penile reconstruction (Monstrey et al., 2001; Jarolim, 2000; Sohn and Bosinski, 2007; Vesely and Hage, 1999; Hu et al., 2005). Functionally and cosmetically, microsurgical free forearm flaps lead to the best results and may be done as a one session procedure by an interdisciplinary team (Monstrey et al., 2001; Sohn and Bosinski, 2007). Steps of a standardized one- or two-session procedure in an interdisciplinary team are analyzed in Table 1 (Fig. 2a and b).

Details of the operation may differ between leading centres in this field. Some authors prefer to use ileoinguinalis or ileohypogastricus nerves, others prefer clitoral nerves for coaption to the forearm nerves in order to regain orgasmic sensitivity. The clitoris is usually denuded and buried underneath the neopenis.

Due to the complexity of these procedures complications are numerous and should be explained in detail to the patient:

- partial or total flap loss occurring in less than 5% of the cases;
- nerve compression or compartment syndrome due to the prolonged lithotomy position occurring in less than 2%;
- leading causes for re-intervention are urethral complications as fistula and/or stenoses in around 50—60% of all patients.

Penile and prosthesis implantation should be undertaken after at least six months after complete urethral healing and after return of tactile sensitivity to the neopenis (Monstrey et al., 2001; Sohn and Peek, 1999).

Multicomponent hydraulic devices, including a covering of the cylinders with Dacron® in order to prevent migration and erosion of the device lead to the most promising functional and esthetic results. In the authors experience, prosthesis implantation should always be done in two sessions: during the first session only one hydraulic cylinder is implanted with a Dacron sock and left in half-inflation, two-testicle prosthesis are implanted into the neoscrotum formed by the labia majora. Three months later, a reservoir is positioned beside the bladder and one-testicle prosthesis is explanted, using its capsula-formation for positioning of the prosthetic pump mechanism (Fig. 2c).

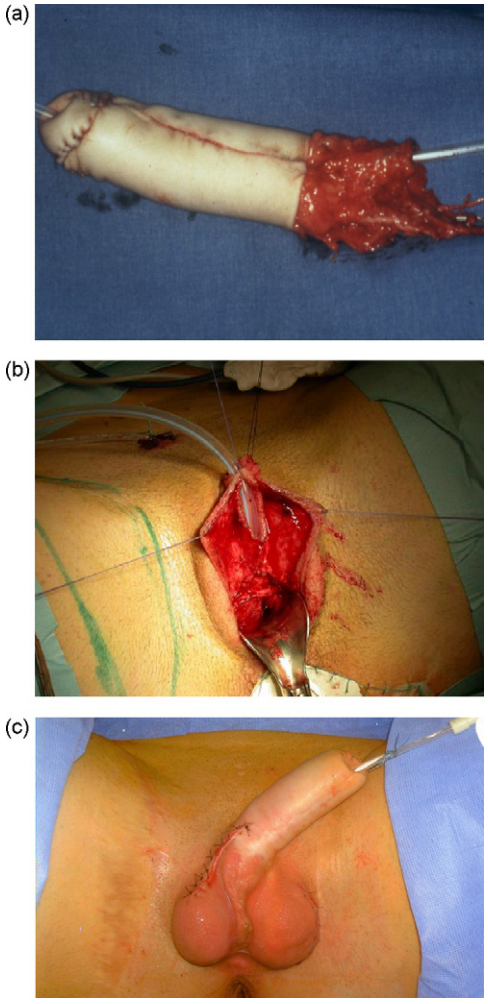

Figure 2 (a): penile and urethral reconstruction from free radial forearm flap before transposition to the genital area; (b): elongation of female urethra to the tip of clitoris. Preparation of dorsal clitoral nerves for coaptation; (c): neophallus and neoscrotum after prosthesis implantation (three component device half-inflated).
(a) : reconstruction pénienne et urétrale à partir d'un lambeau libre de l'avant-bras avant transposition génital ; (b) étirement de l'urètre féminine au sommet du clitoris. Préparation des nerfs clitoridiens dorsaux pour la coaptation ; (c) néophallus et néoscrotum après implantation prothéthique (dispositif à trois composants à moitié gonflé).

Complications are expected to be more frequent than after penile prosthesis implantation in biological male patients and should be explained in detail to the patient (Monstrey et al., 2001; Sohn and Peek, 1999; Hoebeke et al., 2003).

Postoperative follow-up-studies after penile reconstruction in FM-TS patients

Due to the lack of modern phalloplasty techniques, follow-up studies published before 1991 are not helpful. It might

be stated that long-term follow-up data for the elaborated techniques described in this summary are scarcely found in the literature. From two recent reports in small patients cohorts, it may be suggested, that around 80% of patients will be content with the functional and esthetic result of their penile reconstruction. More than 80% are able to reach orgasm by penile stimulation and are able to have sexual intercourse (Hoebeke et al., 2003; Wirsam et al., 2006). Measurement of sensory evoked potentials (Pudendus-SEP) showed normal or slightly prolonged latency times after clitoral nerve coaption to forearm flap nerves. These findings correlate to the fact that in our patient group 72% were able to reach orgasm by neopenis stimulation (Wirsam et al., 2006). These results were confirmed and even surpassed by a recent report of Selvaggi et al., 2007, using an identical surgical technique.

Even if conclusive long-term follow-up data are still lacking on the variety of newer surgical techniques for penile reconstruction, microsurgically transferred free forearm flaps followed by later implantation of hydraulic three-component prosthetic devices seem to be the most promising approach for genital reassignment in FM-TS patients (Monstrey et al., 2001; Sohn and Bosinski, 2007).

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