

## REPLACEMENT PARTS NEEDED (PART II): FEMALE-TO-MALE GENDER CONFIRMATION SURGERY TO PENILE TRANSPLANTS

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November 22, 2017

### OVERVIEW

1. Introduction & indications for genitourinary reconstruction
2. Status of gender re-assignment surgery in Canada
3. Brief overview of the two major female to male procedures:
  - a. Metoidioplasty
  - b. phalloplasty.
  - c. Review of urologic complications of the above procedures
4. Vascularized composite allo-transplantation
5. Benefits and complications
6. Summary

## WHY COMPLEX GENITOURINARY RECONSTRUCTION?

1. Gender-confirming surgery has been used to treat **gender dysphoria**, defined as an inherent discord between a patient's gender expression and their anatomy can also cause significant distress.\*
2. Loss, or severe injury to the external genitalia can create life-changing, often intensely negative psychosocial changes in a person's identity and life.

Techniques for treatment of former have occasionally been used to treat the latter but with advances in medicine, specially vascularized composite allotransplantation treatment options, we may see improvement in treatment options.

\*American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders* 5th edn (American Psychiatric Association, 2013).

## PREVELANCE OF GENDER DYSPHORIA

- Winter and colleagues report that between 0.5%–1.3% of males and 0.4–1.2% of females are estimated to express some form of transgender identity, leading to a conservative estimate of 25 million people worldwide.
- A multidisciplinary approach to gender transition — including input from primary-care providers, psychiatrists, psychologists, endocrinologists, urologists, gynaecologists, and plastic surgeons — is recommended.

Winter, S. et al. *Transgender people: health at the margins of society*. *Lancet* 388, 390–400 (2016). Evaluation of the difficulties experienced by transgender patients in seeking healthcare.

## WORLD PROFESSIONAL ASSOCIATION FOR TRANSGENDER HEALTH (WPATH) STANDARDS OF CARE RECOMMENDATIONS

Criterion	Hormonal therapy	Facial masculinization	Chest masculinization	Genital surgery
Letters from mental-health providers trained in transgender health	Yes (1 required)	No	Yes (1 required)	Yes (2 required)
Persistent, well-documented gender dysphoria	Yes	No	Yes	Yes
Capacity to make a fully informed decision and consent to treatment	Yes	Yes	Yes	Yes
Age of majority in the country of residence	Yes	Yes	Yes	Yes
Well-controlled medical or mental-health comorbidities, if present	Yes	Yes	Yes	Yes
12 continuous months of hormone therapy as appropriate for patient's gender goals (unless medically contraindicated or the patient is unable to take hormones)	No	No	No	Yes
12 continuous months of living as one's true gender	No	No	No	Yes <sup>1</sup>

<sup>1</sup>Only for genital reconstruction and not surgical castration and/or surgical removal of the female sexual organs.

## IN CANADA

- Up until March 1<sup>st</sup>, 2017, patients could only get gender-confirming surgery in Montreal until Ontario approved the procedure and since then, a number of urologists have begun to offer the procedure.
- To be approved for genital surgery, you'll need:
  - **Two** assessments recommending surgery (from a qualified doctor, nurse practitioner, registered nurse, psychologist or registered social worker)
  - One of the assessments must be from a doctor or nurse practitioner
  - Both assessments must confirm:
    - you have a diagnosis of persistent gender dysphoria
    - have completed 12 continuous months of hormone therapy (unless hormones are not recommended)
    - you have lived 12 continuous months in the gender role you identify with (for genital surgery only)

## IN BRITISH COLUMBIA

### MSP provides coverage for:

- Feminizing surgeries:
  - [Orchiectomy](#)
  - [Vaginoplasty](#)
  - [Breast construction](#)
- Masculinizing surgeries:
  - [Chest surgery](#)
  - [Hysterectomy](#) with bilateral salpingo-oophorectomy
  - [Clitoral release](#)
  - [Metoidioplasty](#)
  - [Phalloplasty](#)

## IN BRITISH COLUMBIA

Type of Surgery	Goals
<b>Metoidioplasty</b>	<ol style="list-style-type: none"> <li>1. To create a penis that has sexual sensation and can get erections without the assistance of an implant</li> <li>2. To enable the ability to pee while standing</li> <li>3. <b>The goal is not to enable sexual penetration</b></li> </ol>
<b>Phalloplasty</b>	<ol style="list-style-type: none"> <li>1. To create a penis of typical size and shape with preserved sexual sensation.</li> <li>2. To create a penis with enough length and bulk to be used for penetrative sexual intercourse</li> <li>3. To enable the ability to pee while standing</li> <li>4. To create a penis that can get erections with the assistance of an implant (if desired).</li> </ol>

## OVERVIEW OF FEMALE TO MALE GENDER CONFIRMING SURGERY

- Two surgical options:
  1. Metoidioplasty
  2. Phalloplasty

## DESIRED OUTCOMES FOR FtM GENDER CONFIRMING SURGERY:

1. Ability to micturate in the standing position
2. Creation of an aesthetically pleasing phallus
3. Preservation of clitoral sensation
4. Development of erogenous and tactile phallus sensation
5. Minimization of donor-site morbidity
6. Ability to engage in penetrative sexual intercourse.

## Metoidioplasty

- Pioneered by Laub, Debovic and Durfee in the 1970s, metoidioplasty involves the use of testosterone to hypertrophy the clitoris followed by local tissue rearrangement to produce a microphallus.



Morrison, SD. Chen, ML. Crane, CN. 2017. An overview of the female-to-male gender-confirming surgery. *Nature Reviews Urology*. Vol. 14:486-500.

## OPERATIVE TECHNIQUE

- The one-stage surgery includes:

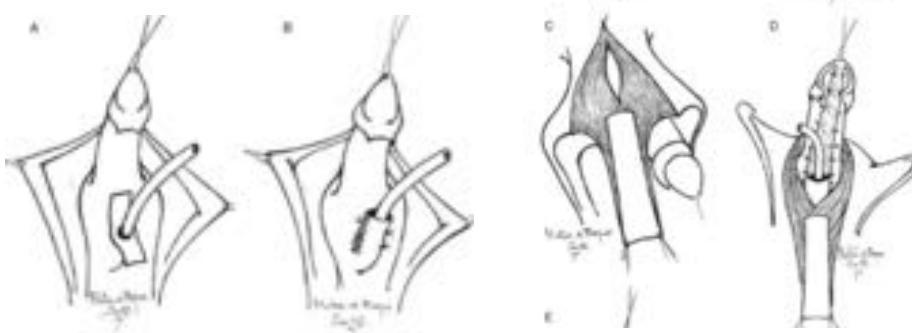
1. Bilateral mastectomy
2. Transvaginal hysterectomy with bilateral oophorectomy
3. Vaginectomy and metoidioplasty with urethral lengthening
4. Testicular prosthesis implantation.

→ The uterus and ovaries are removed using a minimally invasive transvaginal approach, leaving the abdominal wall scar free to avoid compromising possible abdominal phalloplasty in the future.

→ Vaginectomy is performed by total removal of the vaginal mucosa (colpocleisis), with preservation of the part of anterior vaginal wall near the urethra, which will be used for urethral lengthening.

## METOIDIOPLASTY AND URETHRAL LENGTHENING

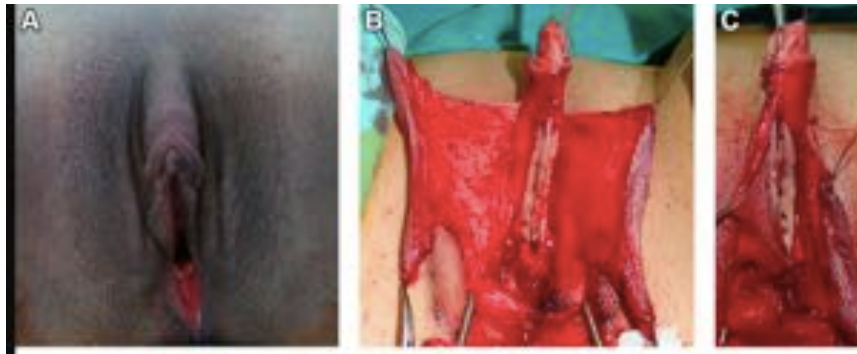
1. Clitoris is straightened and lengthened by division of both clitoral ligaments and the short urethral plate
2. Urethroplasty is performed by combining the buccal mucosa graft and genital flaps



Stojanovic, B et al. One-Stage Gender-Confirmation Surgery as a Viable Surgical Procedure for Female-to-Male Transsexuals. *The Journal of Sexual Medicine*. Volume 14, Issue 5, May 2017, Pages 741-746

## METOIDIOPLASTY AND URETHRAL LENGTHENING

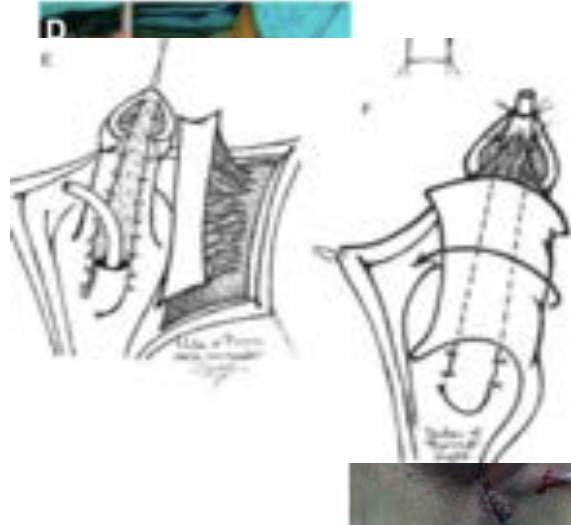
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## METOIDIOPLASTY AND URETHRAL LENGTHENING

3. Reconstruction of the neophallus starts with the incision beneath the glans, at the border between the inner and outer layers of the clitoral prepuce, and continues around the urethral plate and native urethral orifice.
4. Urethra is lengthened using anterior vaginal wall and buccal graft.
5. The length of the graft depends on the distance from the tip of the glans to the native urethral orifice and ranges in 4.5-7cm.\*



Stojanovic, B et al. One-Stage Gender-Confirmation Surgery as a Viable Surgical Procedure for Female-to-Male Transsexuals. *The Journal of Sexual Medicine*. Volume 14, Issue 5, May 2017, Pages 741-746

## ADVANTAGES OF METOIDIOPLASTY

1. Preservation of blood flow and engorgement, erogenous and tactile sensation without risking donor site morbidity
2. Standing micturition is possible for slender patients with favourable anatomy (plentiful labia minora tissue and a long clitoris).
3. Good erectile function.
4. No donor site morbidity.

**Studies that quantified micturition capability and erection formation showed that 94% and 100% of patients, respectively have these abilities.\***

1. Vokadinovic, V., Stojanovic, B., Majstorovic, M. Milosevic, A. (2014) The role of clitoral anatomy in female to male sex reassignment surgery. *Scientific World Journal*. 437378.
2. Morrison, S.D., et al. Phalloplasty: a review of techniques and outcomes. *Plast. Reconstr. Surg.*, 138 594—6615 (22016)
3. Djordjevic, ML., Bizik MR. Comparison of two different methods for urethral lengthening in female to male (metoidioplasty) surgery. *J. Sex. Med.*, 10. 1431—11438 (22013).



## COMPLICATIONS OF METOIDIOPLASTY

1. Urethral strictures and fistulae at the anastomosis of the native urethra with the urethroplasty flaps (vaginal mucosa or labia minora) occur in approximately 16% of all cases.<sup>2</sup>
2. Short average penile length between 4-10 cm and inability to have penetrative sexual intercourse.<sup>1,2,3</sup>
3. Non-resolution of the gender dysphoria resulting in approximately 25% of patients going on to receive phalloplasty.<sup>2,3</sup>



1. Vokadinovic, V., Stojanovic, B., Majstorovic, M. Milosevic, A. (2014) The role of clitoral anatomy in female to male sex reassignment surgery. *Scientific World Journal*. 437378.
2. Morrison, S.D., et al. Phalloplasty: a review of techniques and outcomes. *Plast., Reconstr., Surg.* 138 594–615 (2016).
3. Djordjevic, M.L., Bizik MR. Comparison of two different methods for urethral lengthening in female to male (metoidioplasty) surgery. *J. Sex., Med.* 10. 1431–11438 (2013).

## PHALLOPLASTY

- The procedure to enable use of local or distant tissues to construct a composite phallus and urethra has been modified numerous times since its inception by Bogoras in 1936.<sup>1</sup>
- Common current techniques include:
  1. Suprapubic pedicled flaps
  2. Latissimus dorsi free flap
  3. Groin flaps
  4. Osteocutaneous fibula free flap
  5. **Radial forearm free flap (RFFF) \*\*MOST COMMON**
  6. **Anterolateral thigh pedicled or free flap (ALT)**

1. Bogoras, N. Über die volle plastische Wiederherstellung eines zum Koitus fähigen Penis (Penioplastica totalis) [Ggerman]. *Zentralbl. Chir.* 63: 1271-1276 (1936)

## RADIAL FOREARM FREE FLAP TECHNIQUE

- RFFF is the most commonly used flap technique in contemporary phalloplasty.

### ANATOMIC CONSIDERATIONS

<b>Tissue:</b>	Skin and fascia; optional tendon and bone
<b>Innervation:</b>	Yes with advents of new techniques
<b>Blood supply:</b>	Radial artery and perforators from the radial artery.
<b>Artery:</b>	Large caliber artery.
<b>Vein(s):</b>	The veins of the radial artery can be small. The subcutaneous venous system or cephalic vein can be used for drainage, making for a larger caliber vessel.
<b>Pedicle length:</b>	Can be dissected up to the takeoff from the brachial artery just distal to the antecubital fossa.

## RFFF TECHNIQUE

- Two surgical teams, a plastics and a urology team operate simultaneously. Surgery starts with patient in lithotomy position while the urologist performs a vaginectomy, and lengthens the urethra with mucosa between the minor labia.
- 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.



Morrison, SD. Chen, ML. Crane, CN. 2017. An overview of the female-to-male gender-confirming surgery. *Nature Reviews Urology*. Vol. 14:486-500.

## RFFF TECHNIQUE

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. This is commonly performed on the ulnar aspect of the skin island.



Morrison, SD. Chen, ML. Crane, CN. 2017. An overview of the female-to-male gender-confirming surgery. *Nature Reviews Urology*. Vol. 14:486-500.

## Why RFFF?

- Due to its favorable anatomical characteristics, RFFF was pioneered as a single stage tube-in-tube reconstruction, with concomitant glansplasty.
- The Norfolk technique is most commonly used for coronal creation and the glans can be later tattooed to improve aesthetics.
  - A small skin flap and a skin graft are used to create a corona and simulate the glans of the penis.



## POST OPERATIVE COURSE OF RFFF

- 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.

## DISADVANTAGES OF PHALLOPLASTY (RFFF & ALT)

1. Urethral strictures and fistulas in up to 42% of the patients.<sup>1,2</sup>
  - At site of anastomosis
1. Donor site morbidity is considered to be the main disadvantage of RFFF (as well as other phalloplasty techniques).
  - Great stigma associated with forearm scar.
  - Infection and poor healing
  - Requirement of concomitant free groin flaps for coverage of arm donor site

1. Monstrey S, Hoebcke P, Selvaggi G et al: Penile reconstruction: is the radial forearm flap really the standard technique? *Plast Reconstr Surg* 2009; 124: 510.  
 2. Bettocchi C, Ralph DJ and Pryor JP: Pedicled pubic phalloplasty in females with gender dysphoria. *BJU Int* 2005; 95: 120.  
 3. Sopko, N. et al. Penile Allotransplantation for Complex Genitourinary Reconstruction. *J Uro*: Vol. 198, 274-280, August 2017.

## DISADVANTAGES OF PHALLOPLASTY (RFFF & ALT)

3. Drawbacks of the RFFF also include atrophy of the phallus over time, colour mismatch, the necessity of forearm depilation, and difficulty obtaining bulk in the neophallus.



Monstrey, S. Sex Reassignment Surgery in the Female-to-Male Transsexual *Semin Plast Surg.* 2011 Aug; 25(3): 229–244.

1. Monstrey S, Hoebeke P, Selvaggi G et al: Penile reconstruction: is the radial forearm flap really the standard technique? *Plast Reconstr Surg* 2009; 124: 510.  
2. Bettocchi C, Ralph DJ and Pryor JP: Pedicled pubic phalloplasty in females with gender dysphoria. *BJU Int* 2005; 95: 120.

## Disadvantages of Phalloplasty (RFFF and ALT)

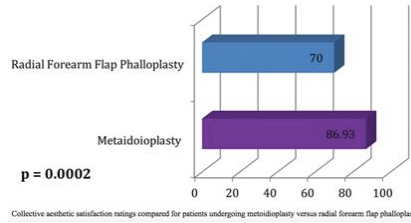
4. Phalloplasty techniques do not allow for natural erection as they lack the requisite erectile tissue.
- Commonly a penile prosthesis is implanted into the neophallus to achieve erection.
  - Overall postoperative complication rates range between 23% and 41.1% requiring revision or removal of the device, including:
    1. prosthesis erosion
    2. Malrotation
    3. Infection
    4. Device failure



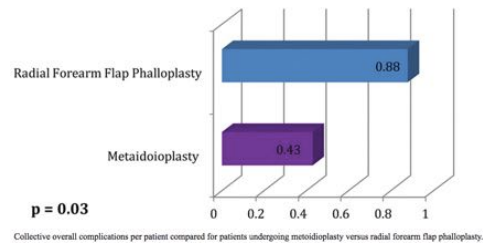
Frey JD, et al. A Systematic Review of Metoidioplasty and Radial Forearm Flap Phalloplasty in Female-to-male Transgender Genital Reconstruction: Is the "Ideal" Neophallus an Achievable Goal?

## METOIDIOPLASTY VS. PHALLOPLASTY

### Aesthetic Satisfaction (%)



### Overall Complications per Patient



Frey, JD. Et al. A Systematic Review of Metaidoioplasty and Radial Forearm Flap Phalloplasty in Female-to-male Transgender Genital Reconstruction: Is the "Ideal" Neophallus an Achievable Goal? *Plast Reconstr Surg Glob Open*. 2016 Dec; 4(12): e1131.

## VASCULARIZED COMPOSITE ALLOTRANSPLANTATION

## COMPLEX GENITOURINARY RECONSTRUCTION: PENILE TRANSPLANTS

- Vascularized composite allotransplantation (VCA) is increasingly being used to successfully replace complex functional tissues including the face, hands and limbs.
- Penile transplantation is a novel vascularized composite allotransplantation treatment option for severe penile tissue loss and disfigurement.
- Three cases have been reported thus far.

## INDICATIONS FOR PENILE TRANSPLANTATION

1. **Severe penile tissue loss**
  - Wartime experiences involving improvised explosive device, causing injury often sustained along with limb injuries, which may limit the availability of tissue phalloplasty.
  - Non-wartime traumatic injury such as the treatment of penile cancer or severe infections.
2. **Congenital penile malformations**
  - Bladder exstrophy epispadias complex
  - Complex severe hypospadias
  - Micropenis
  - Ambiguous genitalia

## PENILE TRANSPLANTATION

- In cases of prior failed phalloplasties, lack of suitable donor tissue (concomitant extremity disfigurement) or severe pelvic tissue disfigurement requiring more than pendulous penile tissue reconstruction, VCA may be the only option for adequate tissue reconstruction.
- Although only 3 cases have been performed to date, the results have been encouraging and suggest that a transplanted penis may not involve the same challenges seen with phalloplasty, including urethral complications and inability to achieve natural erections.

## FIRST CASE: 44-YEAR-OLD MAN IN CHINA

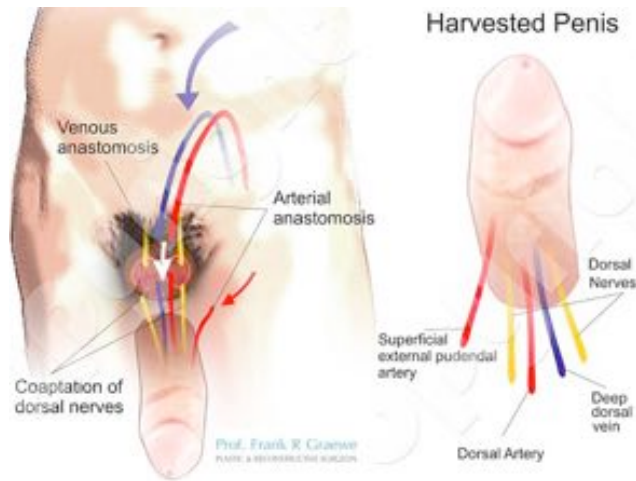
- In 2006, the recipient experienced a traumatic injury resulting in the loss of most of his pendulous penile tissue.
- The donor was a deceased 22y.o. human leukocyte antigen and blood group.





## ANATOMY OF THE TRANSPLANT

The penis was transplanted to the native stump by approximating the tunica albuginea, Buck fascia, skin and urethra, and microsurgical anastomoses of the dorsal arteries, superficial and deep dorsal veins, and the dorsal nerves were performed.



## POST OPERATIVE COURSE

- The patient was maintained on a regimen of mycophenolate mofetil, prednisone and cyclosporine.
- The Foley catheter was removed on postoperative day 10 and the patient voided spontaneously. Epidermal necrosis of the transplanted penile shaft skin was noted.
- The graft was removed at the request of the patient due to severe psychological distress of the recipient and his wife on postoperative day 14. Histology of the penile shaft did not demonstrate tissue rejection.

## CASE #2: 21-YEAR-OLD MAN IN AFRICA

- In 2015, a 21-year-old man who lost his entire pendulous penis due to complications after a ritual circumcision received a successful penile transplant.
- Two subsequent procedures after transplantation were performed to remove a clot in one of the penile arteries and to debride a hematoma and repair a urethral fistula.
- The patient reported natural and spontaneous erections 3.5 months after penile transplantation and voids without difficulty.



Transplant team (l-r) plastic surgeon Prof. Frank Graewe, urologist Prof. André van der Merwe and immunologist Prof. Refique Moosa. Photo: Chris Bateman.

## FIRST PENILE TRANSPLANT RECIPIENT 'TO BECOME FATHER'



The penile transplant operation lasted for about nine hours

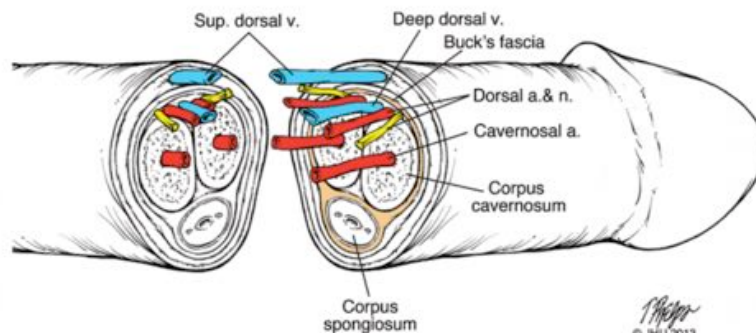
## ADVANTAGES OF PENILE TRANSPLANTS

Initial cases show promise and provide examples of the theoretical advantages of penile transplantation over conventional reconstructive techniques.

1. More normal appearing phallus
1. More successful urinary transport
2. More natural erogenous sensation and ability to achieve natural erections as seen in the second transplantation.
3. Easier penile prosthesis surgery given the structural support of tunica albuginea.

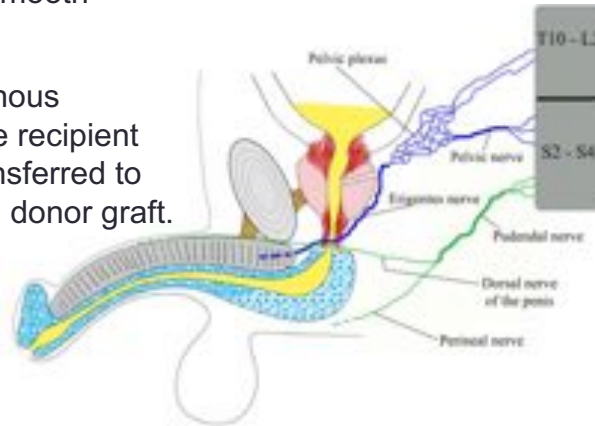
## PENILE VASCULARIZATION

- The penis has 3 main vascular perfusion territories:
  1. Shaft skin
  2. The glans and corpus spongiosum
  3. The corpora cavernosa



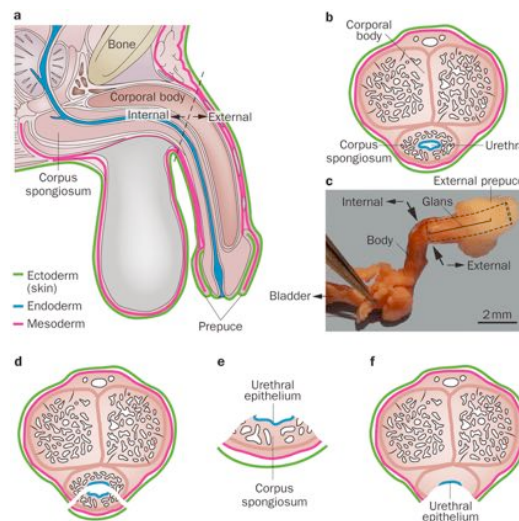
## PENILE INNERVATION

- Cavernous nerves → autonomic innervation responsible for initiating corporal smooth muscle relaxation.
- Additionally, cavernous engorgement in the recipient stump may be transferred to the communicating donor graft.



## ANATOMICAL AND FUNCTIONAL CONSIDERATIONS

- Distal vs. proximal reattachment
- Transgendered FtM tissue discrepancy
- More extensive damage in war injuries
- Differences in anatomical tissue in congenital anomalies.



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## IMMUNOSUPPRESSION AND REJECTION

- One of the largest ethical concerns surrounding penile transplantation and other VCAs involves the significant risk associated with chronic immunosuppression that would be incurred for a graft that is not lifesaving.
- Currently no standard immunotherapy regimen for VCA exists (The typical 3 drug regimen is used—Tac, mycophenolate, and steroids).
- More information is needed for optimization of the anti-rejection regimen for penile transplants.

## MULTIDISCIPLINARY APPROACH

- Recipients are extensively screened to assess their ability to cope with potential psychological stressors involved with receiving VCAs and adhering to lifelong immunosuppression.
  - Will require follow up with urologist, plastic surgeon immunologist and ongoing psychosocial support
- As penile transplants become more frequent, trained organ procurement organization coordinators will be needed to perform many critical steps, such as obtaining consent for donation and coordinating among the many surgical teams commonly involved in harvesting organs and tissues from a single donor.

## CONCLUSIONS

- Additional cadaveric studies may provide insight into how a pendulous penile graft can be transplanted in these settings.
- Although conventional reconstructive options including phalloplasty can provide satisfactory aesthetic results, they have significant complication rates and often do not recapitulate normal penile function, including urinary transport and natural erectile function.
- However, the consequences of lifelong immunosuppression are not trivial and whether they are offset by the potential gains achieved with this nascent procedure is still unknown.
- This issue of equipoise continues to be actively debated throughout all areas of VCA. To uphold our prime objective of “first do no harm,” the field must invest in the requisite preclinical research to optimize penile transplantation.

## THANKS TO:

- Dr. Kavanagh, UBC Urology
- Dr. Carol Kashefi, Scripps Health Urology