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Opinion

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Strategies to prevent and mitigate common complications in gender affirming penile inversion vaginoplasty

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Abstract

While the number of gender-affirming procedures continues to boom all over the world, resulting complications from genital surgeries are on the rise as well. This paper aims to review some of the most commonly described complications of gender-affirming vaginoplasties and provide our expert opinion on how to mitigate them based on the senior author's experience. Specifically, poor cosmesis, soft tissues related complications, rectal and urethral injuries, neovaginal stenosis, as well as intraoperative and postoperative bleeding will be addressed.

Keywords: Transgender, vaginoplasty, gender-affirming vaginoplasty, complications

INTRODUCTION

Much has changed in the overall surgical landscape over the past few years, with the incorporation of more gender-affirming programs throughout the world. Although this long-needed change means faster access to surgical care by transgender and gender non-conforming individuals, it also brings an uptake in post-surgical complications, which have been reported to range from 15%[1] to 70%[2].

Adequate training should be pursued by all practitioners willing to dedicate a large portion of their careers to gender-affirming procedures. Amongst those procedures, genital surgeries are rightfully often seen as more demanding and requiring more expertise than so-called top surgeries.

This paper aims to review some of the most common complications encountered in gender-affirming vaginoplasty and provide some strategies to mitigate them based on our experience of a large-volume center.

We present our opinion on how to decrease or treat some of the most serious or most encountered complications based on preliminary reports of 1004 vaginoplasties performed by a single operator over five years from 2010 to 2014 inclusively. Specifically, poor cosmesis, soft tissues related complications, rectal and urethral injury, neovaginal stenosis, as well as intraoperative and postoperative bleeding will be discussed.

PATIENT SELECTION, TIMING OF SURGERY AND MANAGEMENT OF EXPECTATIONS

The preparation leading to surgery should not be overlooked as some postoperative complications could be easily prevented by better patient education and, in some cases postponing of intervention until certain criteria are met. The WPATH standards of care in the version currently in use (version 7)[3] have been useful in making sure that some of the criteria were met prior to surgery but are not always enough to predict good outcomes of vaginoplasty. Strict adhesion to a dilation protocol is of paramount importance to achieve long-term function and satisfaction[4]. The resulting loss of depth encountered in non-compliant patients can be devastating and will often require additional morbid procedures for a secondary deepening of the neovaginal cavity. To avoid such situations, the surgical team needs to be aware of patient-related situations (lack of support in the workplace, lack of family support, poor logistical feasibility of a demanding dilation protocol both at home and at work, financial issues preventing good postoperative hygiene, *etc.*) that would ultimately lead to non-compliance and work with the patient ahead of the surgical procedure. We believe that this is best achieved with a multidisciplinary approach, and we do have a dedicated preoperative team composed of nurses and social workers.

During the preoperative planning, it is important to recognize the lack of available local genital tissue (genital hypoplasia caused by early puberty blockers, shortened penile skin tube after aggressive circumcision, or other anatomical factors), and have an informed discussion with the patient as far as possible technical difficulties, need for additional techniques, or perhaps simply the limitation of depth when the patient refuses any additional procedures [Figure 1]. Gender-affirming vaginoplasty is not merely a reconstruction of a function, but rather a construction of a new function[5,6]. Tissues are remodeled as per the native anatomy, but the function is newly created with a diversity of postoperative outcomes from excellent to less favorable. A lot of postoperative frustrations can be avoided by reviewing patients' expectations and ensuring that the surgeon can meet those or discuss any reasonable alternatives. A true informed consent is then achieved by both the surgeon and the patient's collaborative path and might be the best way for patients to reappraise their care[7].

COSMESIS AND THE IMPORTANCE OF SYMMETRY

Surgical markings need to be made as symmetrical as possible as the cosmesis of the vulva is a very important outcome of the procedure. The surgeon needs to keep in mind that patients will not only spend a significant amount of time with a mirror to perform dilations but also to get familiar with their new anatomy and experiment with newer sexual sensations. During this time, any significant symmetry issue will be noticed, and could cause the patient to feel dissatisfied, anxious, or even dysphoric.

Figure 1. Penoscrotal hypoplasia.

Gender-affirming vaginoplasty is a procedure of several steps that need to be performed precisely to achieve a good outcome. Most of the procedure is a "midline" surgery, meaning that it is very important to stay centered to get a good symmetry and avoid unnecessary bleeding. For this reason, we believe that spending enough time in setting the surgical field can help avoid complications. In our hands, it is often easier to rely on automatic retraction that does provide the same pull on either side or to use the fingers of the non-dominant hand of the operator rather than asking assistance from an additional person [Figure 2]. Either way, the choice of retractors, as well as the overall set-up, will help the surgeon to become safer and more efficient in most situations. Figure 3 depicts our set-up.

SOFT TISSUES COMPLICATIONS (NECROSIS, WOUND DEHISCENCE AND HYPERGRANULATION)

Wound healing issues are very common after penile inversion vaginoplasty. They can range from minor wound healing delay, dehiscence, small and larger necrosis, and resulting in hypergranulation.

In the penile inversion vaginoplasty, the penile skin is a flap of variable length which is set under some tension. Adequate tension allows for a natural and cosmetic outcome of the labia, while any additional

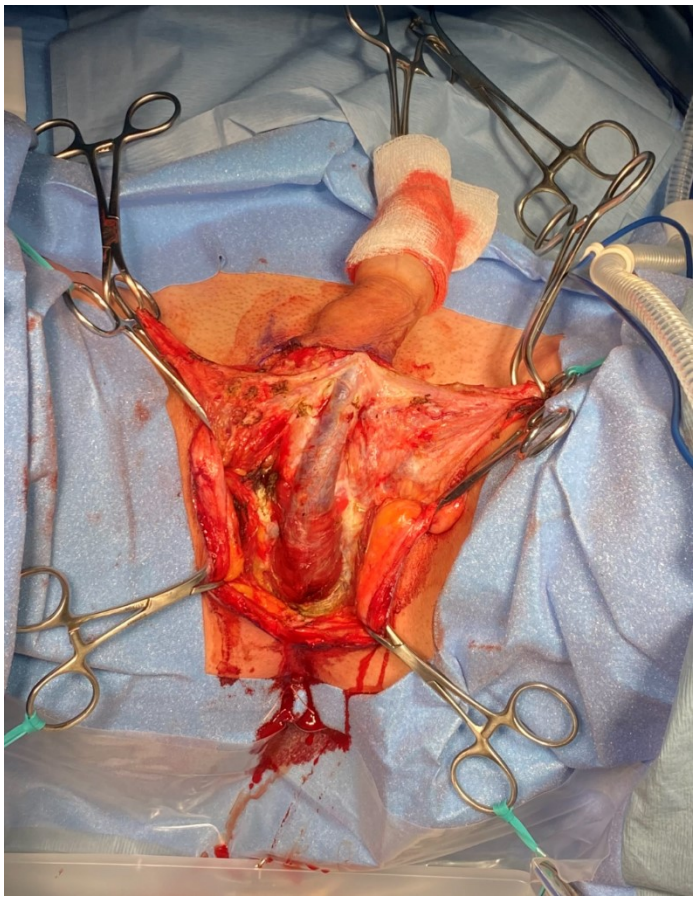

Figure 2. Dissection facilitated by automatic retraction in order to stay midline.

tension will cause early dehiscence, usually at the posterior fourchette. To try and limit this very common problem, we design a triangular perineal flap to break the incision line and limit subsequent contraction. We also place separate Vicryl stitches on the posterior fourchette to give the strength needed against the dilation motion. If dehiscence still happens, it could be of various severity degrees, ranging from a loose stitch to a complete dehiscence [Figure 4]. It is of paramount importance to counsel patients to avoid any cessation of dilation and to treat pain adequately. We found that wet-to-dry dressings using the normal saline solution will always result in complete healing after a few days to a few weeks.

Interestingly, there is a wide range of reporting of these complications in the literature, from 7%[2] to 33%[8]. In our experience, about 75% of patients will experience some level of wound breakdown at the posterior fourchette. A combination of tension, moisture, and the need to perform dilations several times a day while tissues are healing certainly explains the high incidence of this complication. Even though the occurrence is high with wounds sometimes initially impressive, a simple wound dressing protocol (with saline wet-to-dry dressing changes twice a day) and sitz bath will result in complete healing.

Necrosis of the labia can also be encountered as the result of impaired blood flow of the penile skin, either by design, by technical difficulties in the dissection, or by a dressing that was applied too tight. Upon removal of the external bolster dressing at day 4, the skin will typically start presenting a discoloration that can evolve in a complete partial or full-thickness necrosis [Figure 5]. Wound dressing changes will often again be the mainstay of treatment, but the distortion caused by secondary contraction could lead to a poor

Figure 3. Set-up for vaginoplasty with the patient in gynecologic position.

cosmetic outcome [Figure 6]. We therefore advise for early intervention in cases of large necrotic areas that would need to be debrided until healthy tissues are encountered and subsequently covered by a split-thickness skin graft [Figure 7A, B and C].

Hypergranulation is another very common finding after vaginoplasty and will occur in locations where wound healing is achieved by secondary intention, hence directly correlated to soft tissues complications described above. Although reported to range from 7% to 26% of cases[2,9], most surgeons performing gender-affirming vaginoplasties, including at our center, agree that almost every patient will have some degree of granulation[10]. When located in the neovaginal cavity, hypergranulation will be associated with foul smelling, blood spotting, discharges, and pain. The mainstay of treatment is the application of silver nitrate aggressively every week to two weeks. Vaginal douching with a saline solution will also help between sessions of silver nitrate. We found that setting up a hypergranulation clinic with dedicated nurses was very useful for patients to be seen on a regular basis until fully healed.

Bleeding

Bleeding is the most common acute complication of gender-affirming vaginoplasty[10]. There are a few anatomical locations that need to be addressed with caution to reduce the incidence of postoperative bleeding:

Figure 4. Complete posterior dehiscence at the posterior fourchette and partial loss of skin graft.

(1) Perineal arteries: during the initial dissection, staying midline and under bulbospongiosus muscle investing fascia as well as Buck's fascia is critical to avoid the perineal arteries.

(2) The penile stump: it is common to place a circumferential ligation at the base of the penis prior to performing the penectomy. Even if this ligation can be most times efficient in controlling any bleeding from the stump, we advise the placement of selective ligations of the two deep penile arteries, which provides an additional layer of safety.

(3) Bulb of the penis and bulbospongiosus tissue: extra time needs to be taken to cautiously remove all the spongy corporal tissue from the under aspect of tunica albuginea. Injection of epinephrine in the bilateral crus of the corpus cavernosum will significantly reduce the bleeding during this step [Figure 8]. Spongy corporal tissue should be excised with scissors in a gentle peeling motion. We also advise cauterization of any residual tissue, as well as on the lateral aspects of Buck's fascia after having safely identified the neoclitoris pedicle [Figures 9 and 10].

Figure 5. Necrosis of left labia majora.

(4) Urethral edges are oversewn with a running 4-0 Vicryl stitch on a taper needle.

(5) Prostate venous plexus and anterior artery: while approaching the prostate during the dissection cavity, controlling of any bleeding around the prostate.

(6) Neovagina sidewalls: after the initial dissection of the neovagina cavity, both the depth and the width are assessed. The extent of the depth is limited by the peritoneum reflection. The width, however, can be slightly increased by selectively dividing the levator ani muscles. During this maneuver, adjacent internal pudendal artery and vein can be injured and sometimes hard to control because of their location. We advise a cautious dissection and the use of a figure of eight stitches (of Vicryl, for example) to control any bleeding that would occur.

Because of the major bleeding risk in the early postoperative period, a large bolster dressing is applied to the perineal area, with an extra emphasis on a proper bolstering of the spatulated urethra, and after a neovaginal mold has been placed. The dressing is usually tightened from one groin to the other. It needs to be applied with enough pressure to prevent postoperative bleeding with keeping in mind the tissue necrosis that could result from overtightening. Thrombo-embolic prophylaxis is not used, and patients are asked to ambulate a few hours after surgery.

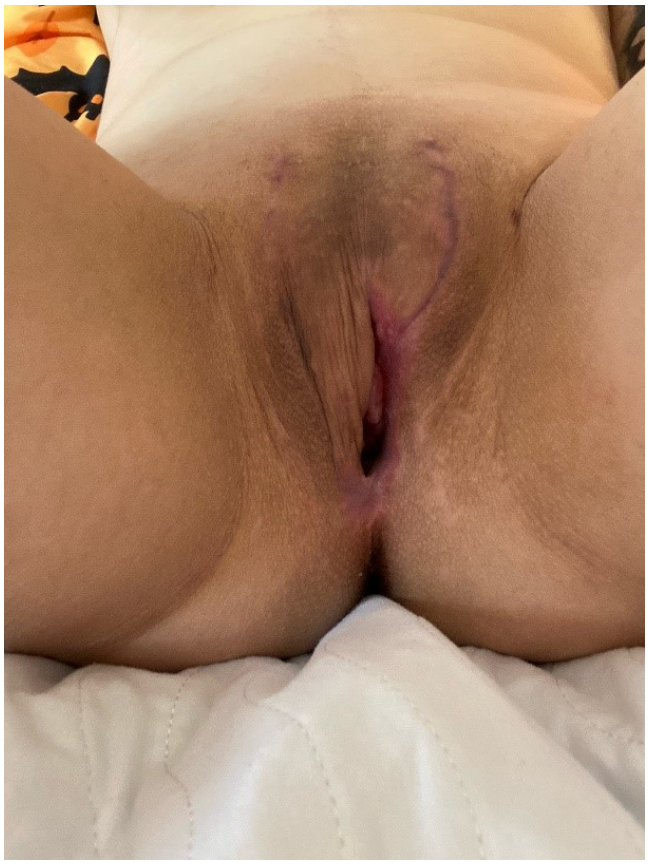

Figure 6. Cosmetic deformity of vaginoplasty outcome, with left labia majora loss and scar contracture.

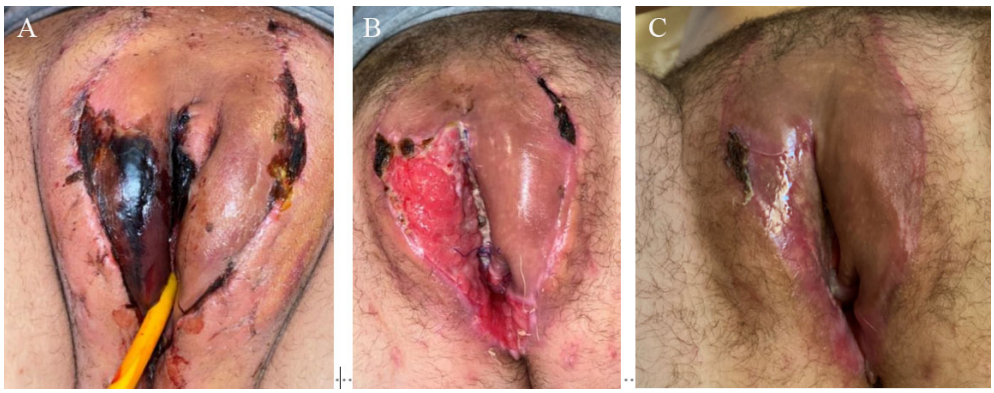

Figure 7. A: Necrosis of the right labia majora; B: after debridement; C: after healing of split-thickness skin graft.

In the postoperative setting, most bleedings will be venous and coming from the urethral edges or the bulb of the penis. These bleedings cause the dressing to be progressively soaked, hence, not acting as a good bolster on the operative site anymore. A return to the operating room is needed in about 1.9% of cases. In our opinion, early recognition of the problem and dressing change under short anesthesia will avoid trying unnecessary bedside measures.

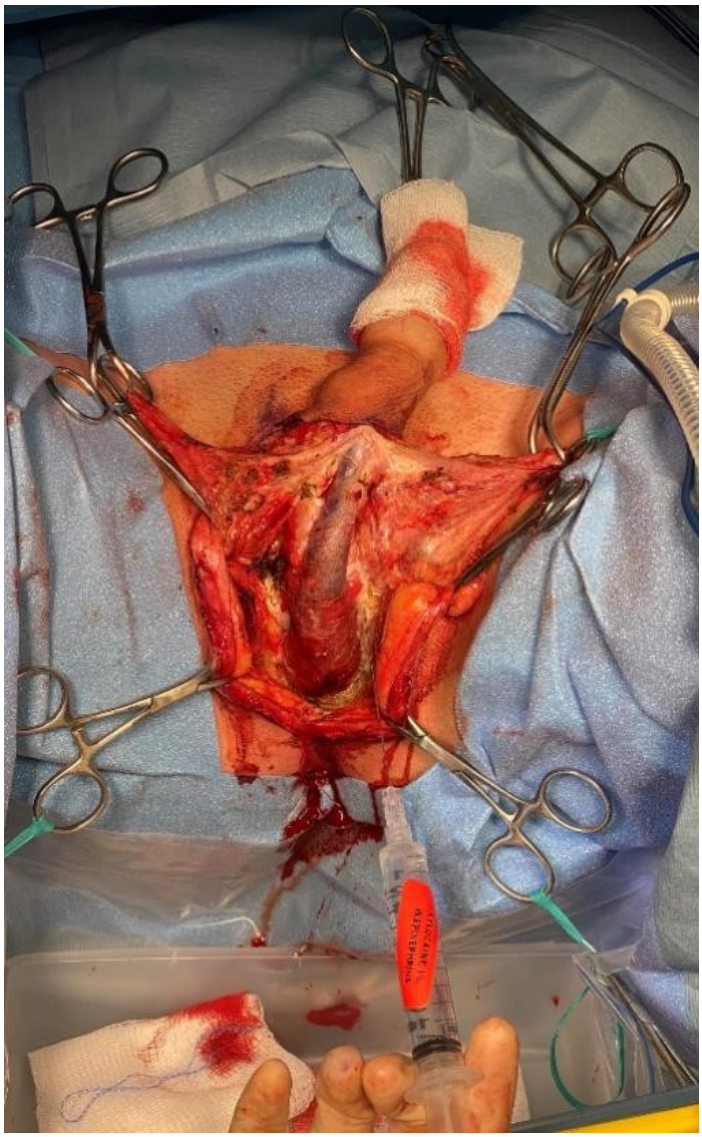

Figure 8. Injection of epinephrine solution in the crus of corpus cavernosum.

Any increasing pain felt while there is bleeding should raise the surgeon's awareness that there might be active arterial bleeding, slowly dissecting the tissues or that an outside blood clot is getting larger and causes increased pressure between the dressing and the wound [Figure 11]. Patients will typically complain of pain becoming progressively more intense and a sensation of the need to defecate. In those cases, patients need to be taken emergently back to the operating room for evacuation of any hematoma and exploration of the site in search of any active bleeding.

While most patients are able to recover from an episode of postoperative bleeding, transfusion was needed in about 2.8% of patients.

Rectal injury/rectovaginal fistula

One of the most dreaded steps of the gender-affirming vaginoplasty procedure is the dissection of the cavity because of the proximity of the rectum posteriorly and the presence of venous networks, and possibly the

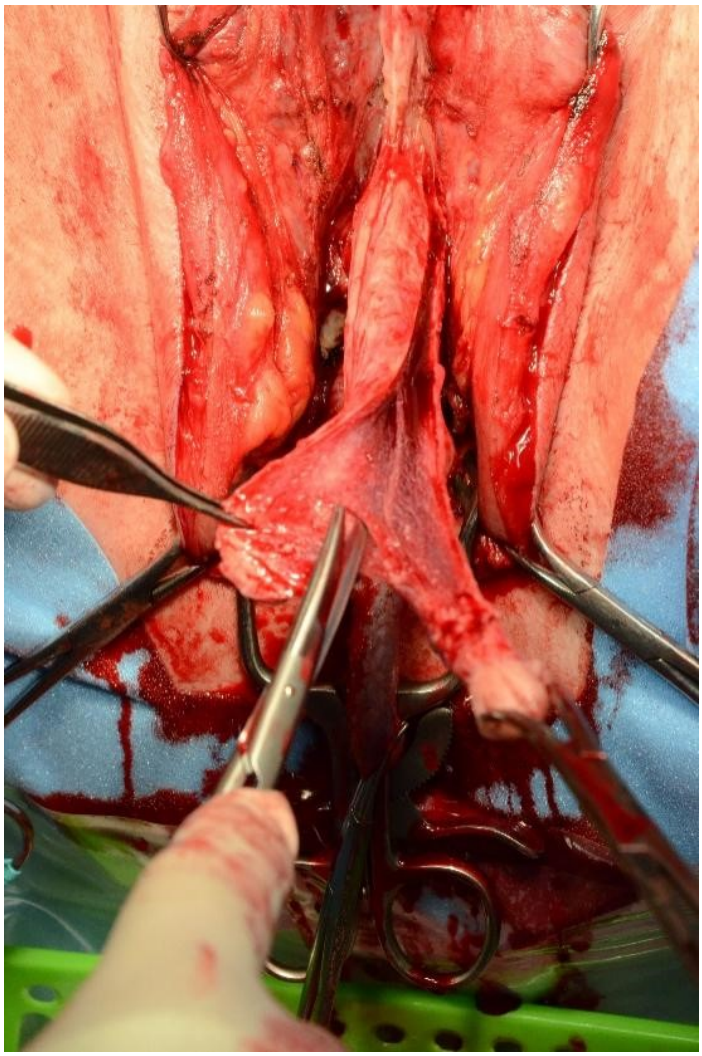

Figure 9. Peeling of residual spongy corporal tissue beneath tunica albuginea.

fact that the perineal anatomy is overall less known. Surgeons need to always keep an awareness of the proximity of the rectum and perform a thorough exam should there be a suspicion of rectal injury. A direct repair of any injury is warranted to help reduce the formation of a rectovaginal fistula[11], which can be harder to treat and could require a diverting colostomy[10]. Rectal injury and rectovaginal fistula are the only postoperative conditions for which the patient needs to stop dilating to prevent worsening the situation and account in the literature for 1%-5% and 0%-2%, respectively[4,10]. The senior author has not reported any rectal injury or rectovaginal fistula cases.

Before starting the dissection, the set-up is once again very important. With the patient in gynecological position, the table is placed in Trendelenburg. This position will place the rectum in a downward position while the surgeon will progress upwards, away from the rectum. A small headlight does facilitate the dissection, as the progression of the neovaginal dissection will be deep and narrow at first. Infiltration of the surgical field with a solution of epinephrine once the set-up is complete, the prostate needs to be mobilized towards the operator, and we achieve this motion by performing gentle traction on the previously placed Foley catheter.

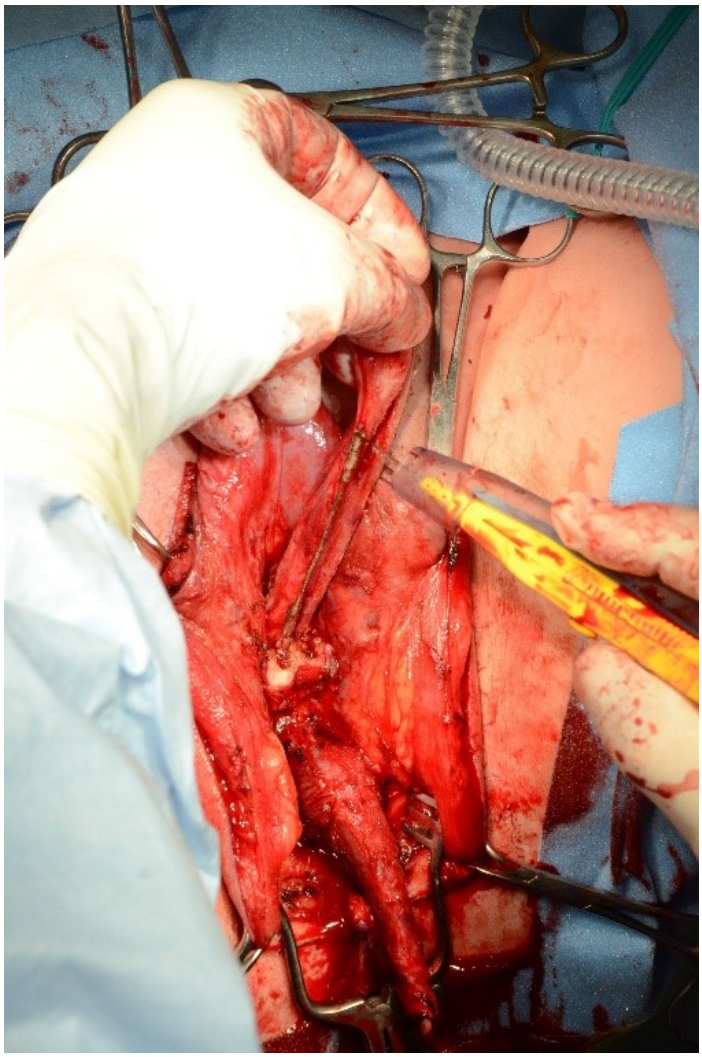

Figure 10. Cauterization of the lateral aspect of Buck's fascia after dissection of the neoclitoris pedicle.

The first very important landmark is the central perineal tendon that will be reached after anterior retraction of the inferior aspect of the bulbospongiosus muscle. The central tendon of the perineum is an elusive anatomical structure that can appear as a white vertical midline structure that can be sharply divided. The dissection then progresses with approximately 15 degrees upwards angle. One should aim the plane of dissection posterior and close to the transverse perineal tendon and Cooper's glands which are easily identifiable most of the time. Although a more anterior dissection is preferable, a urethral injury is seen in 0%-4% of the cases[12] and is the result of a dissection plane taken too anteriorly.

The operator needs to constantly check the plane by trying to feel the prostate. Once the prostate can be palpated at the fingertip, the rest of the dissection can be carried out faster, with the tip of the scissors aiming towards the prostate. The prostatic capsule will then be reached at its caudal portion, and the Denonvillier's fascia can then be peeled off posteriorly. The dissection beyond the prostate can then be done bluntly with a finger performing a sweeping motion until the peritoneal reflection is reached. The neovaginal canal is then assessed for width and widened as necessary by division of the puborectalis muscles, component of the levator ani muscle complex.

Figure 11. Dissecting hematoma of the neovaginal posterior vault.

Neovaginal stenosis

Stenosis can be found either at the introitus in 4.7%[13] or in the neovaginal canal and accounts for 6.4%[14] of cases, although this might be underreporting because of the lack of systematic follow-up. The introitus narrowing can be the result of secondary contraction in the setting of wound dehiscence and/or hypergranulation and is easily treated with a local tissue plasty with or without a skin graft.

Neovaginal cavity stenosis is a tougher issue and results from multiple factors leading to the non-adhesion to the dilation protocol: personal factors preventing dilation, pain, pelvic floor dysfunction. Neovaginal stenosis that requires a secondary deepening has been found in about 0.3% of our patients. Typically, a split-thickness skin graft will be harvested from the thigh and used as lining after a secondary deepening procedure.

It is important that dilation protocol be discussed thoroughly preoperatively and rapidly identify any factors that could lead to non-compliance. Table 1 summarizes our dilation protocol for the first year after surgery. When pain and muscle spasms are systematically felt during dilation, referral to a pelvic floor therapist should be part of the treatment algorithm. In Canada, the only limiting factor is the lack of reimbursement of pelvic floor therapy sessions, and only symptomatic patients will be referred. However, Jiang *et al.* found that as much as 42% of patients undergoing vaginoplasty will have some degree of pelvic floor dysfunction preoperatively, which is an argument for a more aggressive referral to therapists[15].

CONCLUSION

In conclusion, gender-affirming vaginoplasty is a procedure that can be associated with a wide range of complications. Although it can be daunting to think of a surgery that could lead to many adverse situations,

Table 1. Montreal dilation protocol after vaginoplasty

	Month 1	Month 2	Month 3	Month 4-6	Month 7-12	After one year
Am	30 min	30 min	30 min	30 min	30 min ONCE A DAY	30 min ONCE A WEEK
Noon	30 min					
Pm	30 min	30 min	30 min			
Evening	30 min	30 min	30 min	30 min		

most complications will be minor and treated only with wound care and patience. We have shared our experience regarding some well-known complications following vaginoplasty, which we believe could be limited by incorporating a few strategies. It is, however, important to recognize that multiple vaginoplasty techniques have been described, and that what applies to our technique is not necessarily true for others. Nonetheless, we still believe that a few general guiding principles could help mitigate commonly encountered adverse situations.

DECLARATIONS

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Authors' contributions

Conception, design, data analysis and interpretation and manuscript writing: Laungani A
Conception, design, data analysis and interpretation and manuscript writing: Sapin-Leduc A
Conception, design, data analysis and interpretation: Bélanger M
Conception, design, data analysis and interpretation: Brassard P

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All authors declared that there are no conflicts of interest.

Ethical approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

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