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REVIEW

Imaging of transgender patients: expected findings and complications of gender reassignment therapy

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Abstract

Objectives Gender dysphoria is defined as a conflict between the biological gender and the gender with which the person identifies. Gender reassignment therapy can alter external sexual features to resemble those of the desired gender and are broadly classified into two types, female to male (FTM) and male to female (MTF). In this paper we describe expected findings and complications of gender reassignment therapy.

Methods Collaborative multi-institutional project supported by Ovarian and Uterine Cancer Disease Focused panel of Society of Abdominal Radiology.

Results Gender dysphoria is defined as a conflict between the biological gender and the gender with which the person identifies. Gender reassignment therapy can alter external sexual features to resemble those of the desired gender and are broadly classified into two types, female to male (FTM) and male to female (MTF). These therapies include hormonal treatment as well as surgical procedures. FTM genital reconstructive therapy includes creation of a neophallus, which can be achieved by metoidioplasty or phalloplasty with mastectomy, along with testosterone administration. MTF gender reassignment surgery includes complete removal of external genitalia with penectomy and orchiectomy, with vaginoplasty, clitoroplasty, labiaplasty, and breast augmentation along with estrogen supplements.

Conclusion Surgical techniques alter the standard anatomy and make imaging interpretation challenging if radiologists are unfamiliar with expected post-operative appearances. It is important to recognize the complications related to surgical and non-surgical treatment of gender dysphoria to avoid interpretation errors. Furthermore, increasing the prevalence of transgender patients requires increased sensitivity when interpreting imaging studies to reduce the potential for misdiagnoses in reporting due to frequently incomplete available clinical history.

Keywords Computed tomography · Magnetic resonance imaging · Gender dysphoria · Transgender · Sex reassignment surgery

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Introduction

The term "transgender" is an umbrella term for people whose gender identity and/or expression is different from cultural expectations based on the sex they were assigned at birth.

The transgender population is estimated to be 1.6 million (0.6%) of the adult population in the United States [1]. Gender reassignment therapy (GRT), also referred to as gender affirmation therapy, can alter external sexual characteristics to resemble those of the desired gender and are broadly classified into two types, female to male (FTM) and male to female (MTF). The spectrum of treatment includes hormonal as well as surgical procedures (Table 1). Surgeries for FTM gender reassignment aim to alter the female anatomy to resemble that of a male, and include removal of breasts, female genitalia, and reproductive organs, with complete genital and urethral reconstruction. MTF gender reassignment surgery (GRS) includes breast augmentation, removal of male external genitalia, vaginoplasty, clitoroplasty, and labiaplasty. There is a paucity of radiologic literature documenting common imaging findings after gender reassignment surgery. Information regarding a patient's gender identity may not be included in the provided clinical history, especially in imaging performed for other indications. In this review, we describe imaging appearances of normal post-surgical anatomy in FTM and MTF gender reassignment therapies, complications, and pitfalls.

Surgical techniques

Male to female (MTF) gender reassignment

Medical and surgical GRT for male to female patients usually begins with hormone therapy intended to feminize patients by changing fat distribution, induction of breast growth, and reduction of male-pattern hair growth [2]. If sufficient breast growth is not achieved with estrogen supplements alone, breasts can be further enlarged with implants or autologous fat transfer. The surgical options include facial feminization, chondrolaryngoplasty, and vocal cord surgery, and hair removal. The transformation process can include genital reconstruction surgery and body contouring procedures.

Genital reconstruction surgery includes neovaginoplasty, labiaplasty, and clitoroplasty. Neovaginoplasty includes removal of the penis, testicles, spermatic cords, and corpora and creation of a neovagina [3]. Most commonly, the neovaginal canal is constructed using a combination of a tubular graft of skin from the penis and skin grafts from the scrotum (Fig. 1a, b). Sometimes a non-genital skin flap or pedicled intestinal flap such as ileum, cecum, or sigmoid is used for this purpose [4]. A short segment (12–15 cm) of bowel is resected with its blood supply preserved; the proximal aspect of isolated bowel is sutured to form the caudal end of the neovagina while the distal end is anastomosed to the perineal soft tissues. The neovagina is placed in the space created by blunt dissection between the prostate anteriorly and rectum posteriorly [5]. At the end of the procedure, the neovaginal canal is stented with packing material that is removed several days after the procedure. Daily dilatation of the neovagina starts immediately after the packing is removed, with sequential increase in size in the dilators.

Labiaplasty refers to creation or shaping of the labia and can be performed simultaneous with vaginoplasty or as part of a two-stage procedure. As with vaginoplasty, scrotal and penile skin grafts are typically used for labiaplasty. Clitoroplasty refers to the formation of a neoclitoris wherein the glans penis and the inner layer of foreskin along with the neurovascular bundle are used to form the neoclitoris and its prepuce which are sutured under the pubic skin superior to the neovagina [6]. Finally, the native urethra is shortened, matured, and inset between the reconstructed clitoris and vaginal canal [7].

Complications may occur following vaginoplasty, labiaplasty, and clitroplasty. *Stenosis of the neovagina and urethral meatus* are common complications [8, 9]. Insufficient resection of erectile tissue from the corpora cavernosa and

Table 1 Summary of surgical and medical interventions in gender reassignment

Female to male gender reassignment surgery	• Bilateral mastectomy with chest contouring • Hysterectomy with bilateral salpingo-oophorectomy and vaginectomy • Continuous supplemental testosterone induces virilization and suppresses feminizing characteristics • Reconstructive surgeries include metoidioplasty or phalloplasty for creation of neophallus • Urethroplasty and placement of testicular prosthesis and scrotoplasty
Male to female gender reassignment surgery	• Penectomy, orchiectomy, and removal of spermatic cords and corpora • Reconstruction of female external genitalia through vaginoplasty, labiaplasty, and clitoroplasty • Breast augmentation with estrogen supplementation • Cosmetic procedures like feminizing facial reconstruction, laryngoplasty, vocal cord surgery, and permanent hair removal

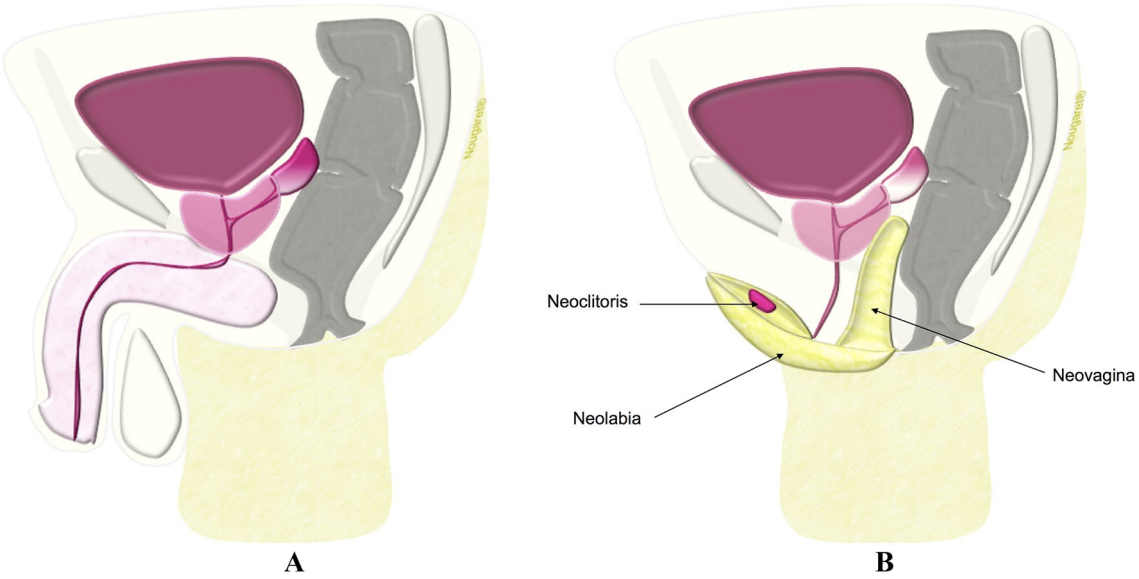

Fig. 1 Male to female gender reassignment surgery. **a** Represents anatomy prior to surgery for comparison. **b** The neovaginal canal is usually reconstructed using penile skin tube and skin grafts from the scrotum. Labiaplasty is usually performed using scrotal and penile skin. The glans penis and the inner layer of foreskin along with the neurovascular bundle are used to form the neoclitoris and its prepuce which are sutured under the pubic skin superior to the neovagina. The urethra is shortened, matured, and inset between the reconstructed clitoris and vaginal canal

corpus spongiosum can result in protrusion of the urethral meatus or swelling and narrowing of the neovagina [10]. Injury to the rectum and bladder may occur during the pelvic dissection for seating of the neovagina [11] and there may be perforation of the rectovaginal wall in the perioperative period or development of a rectovaginal fistula in the long term [9].

Female to male (FTM) gender reassignment

GRT for female to male includes bilateral mastectomy with chest contouring, hysterectomy with bilateral salpingo-oophorectomy, and vaginectomy. These are usually performed prior to reconstruction of the external genitalia. Vaginectomy involves surgical removal of a portion or the entire vagina. Exogenous testosterone is used to induce virilization and suppress feminizing features [2], such as increase in facial and body hair, muscle mass, libido, and acne, alteration in body fat distribution, deepening of the voice, atrophy of the vaginal epithelium, and hypertrophy of the clitoris. Clitoral hypertrophy is important for subsequent genital reconstruction [12].

The key component of FTM genital reconstructive surgeries includes creation of a neophallus which can be achieved by metoidioplasty (creation of neophallus from a hypertrophied clitoris) or phalloplasty. Urethroplasty and scrotoplasty with testicular prostheses complete the female to male genital reconstruction (Fig. 2a, b).

Metoidioplasty is a single-stage procedure for creation of a neophallus where the hypertrophied clitoris is mobilized to form the shaft of the neophallus. A flap of vaginal epithelium is used to extend the urethra to the tip of the neophallus [13]. The resultant neophallus resembles a micropenis. A metoidioplasty-constructed penis is considerably shorter than one created with the phalloplasty technique, ranging from 5 to 7 cm in size, resulting in difficulty with penetration and potentially impaired ability for standing urination. The benefits of the metoidioplasty procedure include ease of the technique, lower risk of complications, and shorter recovery time [14, 15]. The addition of a labia flip will increase the girth of the neophallus.

Phalloplasty is an extensive surgical procedure for creation of the neophallus that more closely resembles the normal penis. Almost all techniques for female to male phalloplasty require a penile prosthesis to enable penetration during intercourse [12]. The modern free flap phalloplasty provides a gross cosmetic appearance vastly superior to older techniques, with normal bulk, appearance, and some functions of the neophallus [13]. Various types of flaps have been used for the neophallus including an anterolateral thigh flap and pedicled abdominal flaps supplied by the inferior epigastric and circumflex iliac arterial systems; however, the radial forearm free flaps are the most commonly used [12]. Phalloplasty can be performed in conjunction with urethroplasty. Urethroplasty involves the advancement of the native female urethra anteriorly and

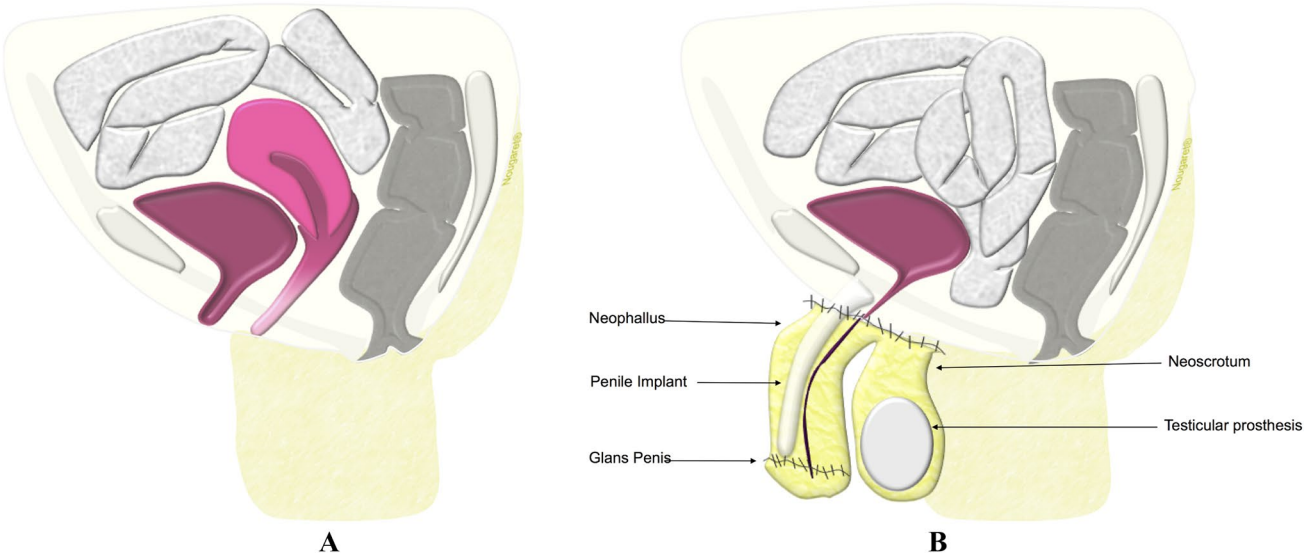

Fig. 2 Female to male gender reassignment surgery. Hysterectomy with bilateral salpingo-oophorectomy and vaginectomy are usually performed prior to external genitalia reconstruction. The key component of FTM genital reconstructive surgeries includes the creation of a neophallus which can be achieved by metoidioplasty or phalloplasty. In metoidioplasty, hypertrophied clitoris is mobilized with extension of the urethra to the tip using a flap of vaginal epithelium with resultant microphallus. Modern free flap (most commonly radial free forearm flap) phalloplasty results in much better cosmetic results. Urethroplasty (allowing for standing urination) and placement of testicular prosthesis with scrotoplasty (from labia majora) are the other components which complete the female to male genital reconstruction (**b**). **a** Represents anatomy prior to surgery for comparison

construction of the neourethra from skin or mucosal grafts [16]. The ability to void standing up is an important goal for the majority of patients.

Scrotoplasty begins with the creation of a neoscrotum. A neoscrotum is typically constructed by fusing the labia majora to form a single sac. A number of skin flaps can be used to recreate the anterior scrotum. Testicular prostheses or silicone implants may be placed in the neoscrotum with or without tissue expansion. Testicular implants can be used for enhanced cosmesis; however, they can be complicated by implant expulsion, mechanical failure, and dislocation [17].

Imaging appearance

CT and MRI are the commonly used imaging modalities for evaluation of patients undergoing gender reassignment therapy. Ultrasound is commonly used to assess superficial structures like the breasts, scrotum/testicle, perineum, labia, and testes in patients undergoing hormonal therapies as well as surgical intervention. Fluoroscopic assessment can be made through urethrography, voiding cystourethrogram (VCUG), vaginogram, and fistulogram. Post urethroplasty procedures in FTM patients can be evaluated for strictures with fluoroscopy (Fig. 3). Mammography is performed for surveillance of MTF patients undergoing hormonal treatment and breast reconstruction.

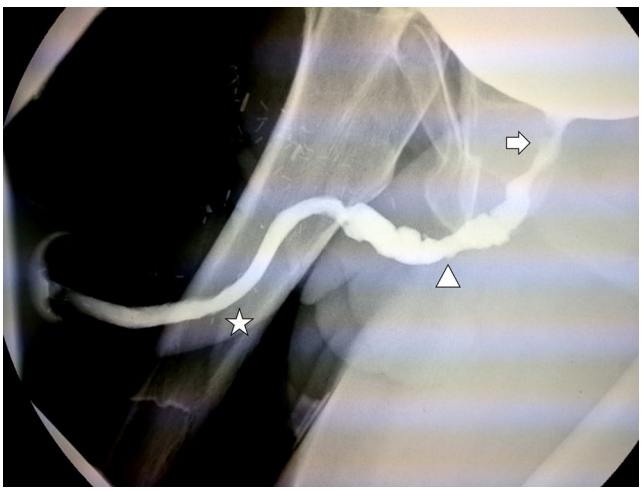

Fig. 3 Voiding cystourethrogram showing normal post-surgical anatomy in female to male patient that includes remaining native urethra (arrow), neourethra (triangle) and neophallus (star). Not pictured: neoscrotum, made from augmented labia majora, vagina closed after mucosa stripped to induce scarring

Male to female (Figs. 4 and 5)

In the immediate post-operative period, the neovagina is usually seen with packing material in situ, which is needed to maintain patency of the canal (Fig. 6a). The shortened urethra can be seen best if a Foley catheter is present. Once

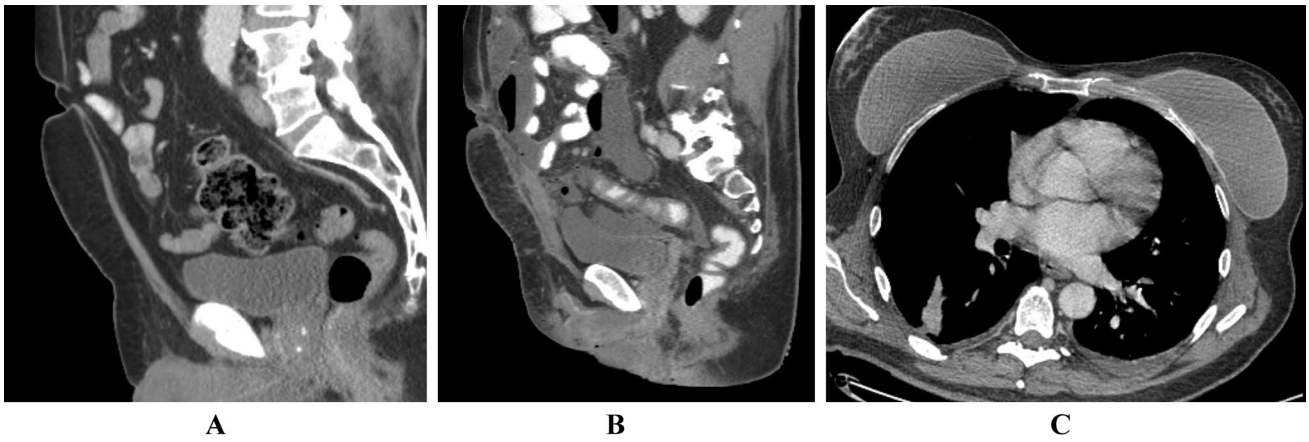

Fig. 4 Pre (**a**) and post (**b**) surgical images in male to female transgender patient: post-surgical changes with absence of penis with clitoroplasty (black arrow), labiaplasty, and neovagina formation (white arrow) posterior to the urinary bladder. Axial images through the chest show breast reconstruction in another patient (**c**)

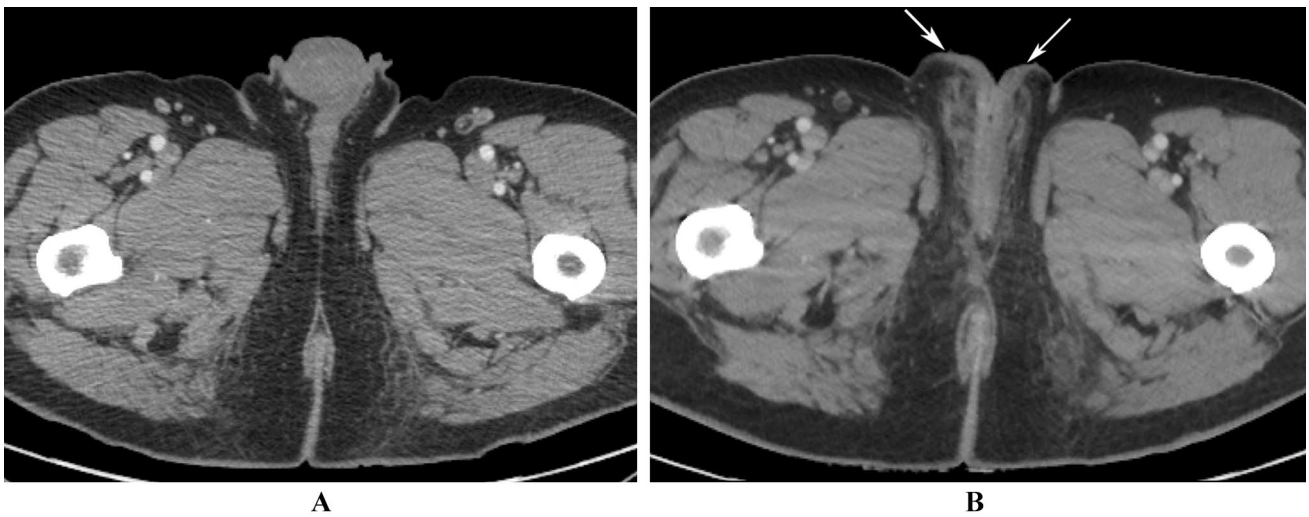

Fig. 5 Pre (**a**) and post (**b**) surgery axial contrast-enhanced CT images in a patient who recently underwent penectomy, orchiectomy, and neovagina creation with labiaplasty. The post-surgical image on the right demonstrates the absence of penis with labiaplasty (white arrows)

the packing is removed several days after surgery, the neovagina is situated in the vesicorectal space and appears as an ovoid soft tissue density structure on axial images and as a tubular structure on the sagittal images with a few air bubbles at the neovaginal opening (Fig. 6b); the neovagina may or may not be fluid filled. When bowel is used to create the neovagina, the mucosal folds can be seen quite well on fluoroscopic studies (Fig. 6c). CT neovaginograms can also be performed to evaluate for leaks or strictures (Fig. 6d). Clitoroplasty is usually identified as a focal soft tissue structure anterior to the pubic symphysis (Fig. 4b). Small hematomas surrounding the neoclitoris are often seen in the early post-operative course (Fig. 6a).

High-contrast resolution of MRI is excellent for anatomical evaluation of the new female anatomy as well as post-surgical complications. Images usually demonstrate an atrophic prostate and seminal vesicles at the bladder base, a neovagina in the vesicorectal space, and absence of penis and testes. The bulbospongiosus muscle can sometimes be preserved during these surgeries, and it is usually seen as low signal intensity tissue between the neovaginal introitus and urethra [7]. The aim of GRS in MTF patients is the creation of a neovagina with adequate depth and a near-physiologic anterior–posterior inclination; the orientation of the neovagina can be well assessed on MRI [18]. It is important to note, however, that the surgeon cannot influence the inclination of the neovagina as it passively follows the

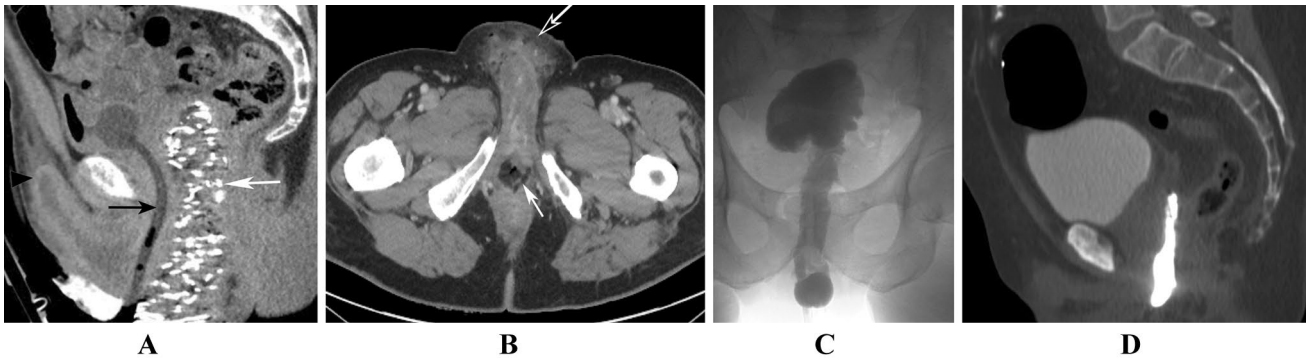

Fig. 6 Neovagina in male to female transgender patient. **a** Foley catheter (black arrow) seen outlining shortened urethral tract. Packing material in the neovagina (white arrow). Hypodense area (arrowhead) anterior to pubic symphysis represents a small hematoma superior to the neoclitoris. **b**. Axial contrast-enhanced CT images in a patient who recently underwent penectomy, orchiectomy, and neovagina creation with labiaplasty. Moderate stranding and post-surgical changes (black arrow) are seen in the prepubic fat. A fat density area with tiny gas locules (white arrow) in the perineum represents the neovaginal opening. **c**. AP views of neovaginogram performed in a transgender MTF patient with foul smelling vaginal discharge 3 months after surgery. Neovaginogram performed after placing Foley catheter inside the introitus shows no evidence of leak. Colon-like appearance of neovaginal canal with blind ending distal end resembling the cecum. **d** Sagittal CT neovaginogram demonstrates no leak

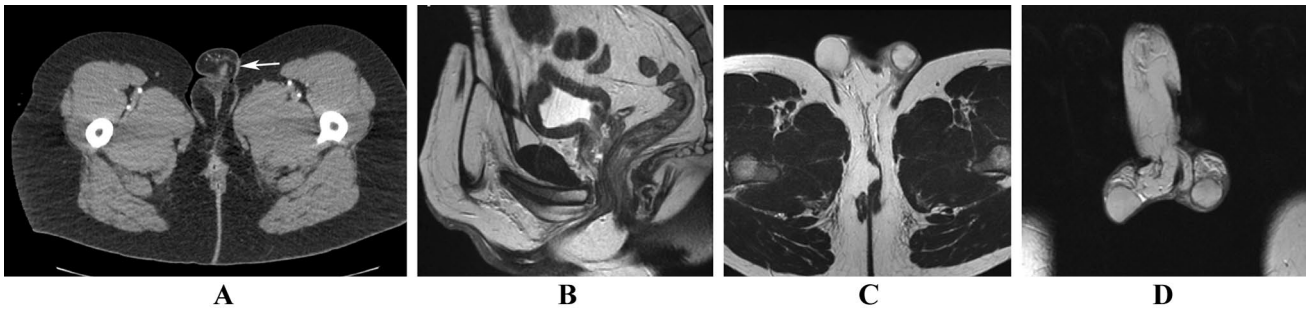

Fig. 7 Neophallus in female to male transgender patient. **a** Female to male gender reassignment surgery with metoidioplasty and neophallus (white arrow). **b** Sagittal T2W image of female to male transgender patient status post right forearm flap transplantation for neophallus formation and urethral reconstruction including perineal flap. MRI was performed to assess vascular supply to neophallus. **c**, **d** Forearm flap phalloplasty: axial and coronal T2W MRI images of neophallus and neoscrotum

course of the rectum posteriorly and the urethra and bladder anteriorly.

Female to male (Fig. 7)

Imaging is usually performed for assessment of post-surgical complications or surgery unrelated indications such as acute or chronic abdominal pain. The main imaging finding is the absence of prostate and seminal vesicles in a male patient. The uterus and ovaries may or may not be present. Depending upon the type of surgery, metoidioplasty (Fig. 7a) or phalloplasty (Fig. 7b, c), the neophallus has a varied appearance. MRI with intravenous contrast can help to assess the vascular supply to the neophallus. CT is preferred to assess testicular prostheses or to verify their presence, though they can also be seen on MRI. Fluoroscopic retrograde or voiding cystourethrogram is performed for assessment of the augmented urethra (Fig. 3). Since pelvic ultrasound is commonly performed in this patient population for evaluation of abnormal uterine bleeding, it is important to remember that dominant follicles or thick endometrium is not seen in patients on testosterone therapy or those with a history of prior hysterectomy and oophorectomy.

Complications

Complications in both patient populations can be surgical and or non-surgical. Male to female gender reassignment surgery involves significant remodeling of the pelvic tissues, predisposing the patients to early post-operative complications, the most common being bleeding, inflammation, ischemia, and iatrogenic injury to adjacent organs leading to fistula formation, and infection [7]. When bowel is used to create a neovagina, bowel ischemia can occur and can lead to

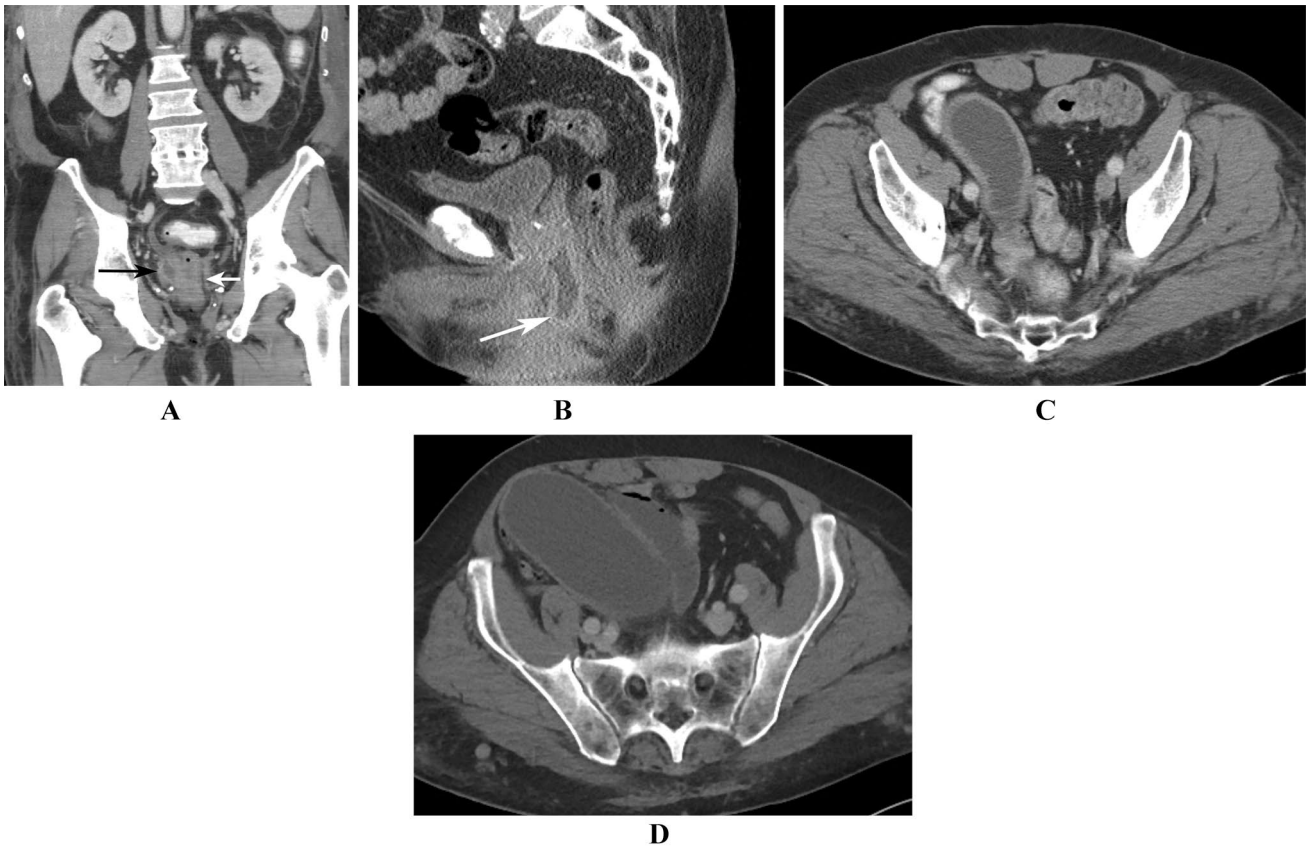

Fig. 8 Neovaginal complications. **a** Coronal CT image demonstrates a peripherally enhancing fluid collection consistent with abscess (black arrow) adjacent to neovagina (white arrow), midline fluid and air-filled structure is neovagina. **b** Sagittal CT image demonstrates fluid in the neovagina with mild surrounding enhancement secondary to neovaginal stenosis. **c** A 73-year-old patient with male to female gender reassignment surgery 25 years ago. Initial CT obtained for pelvic pain shows distended neovagina with thick enhancing walls. **d** CT obtained 2 years later shows progressive dilatation of neovagina due to distal stenosis

bowel necrosis. Perineal abscess formation can complicate the post-surgical course (Fig. 8a). The neovaginal cavity can develop an abscess in the immediate post-operative course due to distal stenosis and longstanding stenosis can lead to persistent neovaginal fluid collections which can be symptomatic (Fig. 8b). Stenosis of the neovagina and urethral stenosis can also complicate the post-operative course in these patients [8, 9, 19].

The gender reassignment surgeries in female to male patients are more prone to develop complications related to urethroplasty, such as urinary dribbling, urethral fistulae, and strictures [20]. Urethrocutaneous and urethrovaginal fistulae (Fig. 9a) are the most common complications with the free flap technique with sinuses and fistulas developing at the anastomosis [21]. Urethral strictures occur at the mucocutaneous junction at the level of the anastomosis and along the course of the reconstructed urethra [13], (Fig. 9b). Imaging evaluation of the urethra can be performed with retrograde urethrogram and voiding cystourethrography. Testicular prostheses can erode through the skin or can be displaced from the confines of the neoscrotum.

In addition to surgeries, these patients may undergo non-surgical cosmetic procedures, such as silicone injections for augmentation of breasts and buttocks. Silicone injections can lead to silicone granuloma formation that can be complicated by cellulitis (Fig. 10). Pyomyositis can be seen in the setting of intramuscular testosterone injections (Fig. 11). Hormonal treatment can lead to the development of deep venous thrombosis particularly after estrogen replacement. In rare cases, hormonal injections can also lead to the development of pulmonary embolism. Male to female transgender patients on hormonal therapies awaiting surgery can also contract common male diseases like epididymitis or scrotal hematoma. Rarely, some of the female to male patients can also present with pregnancy.

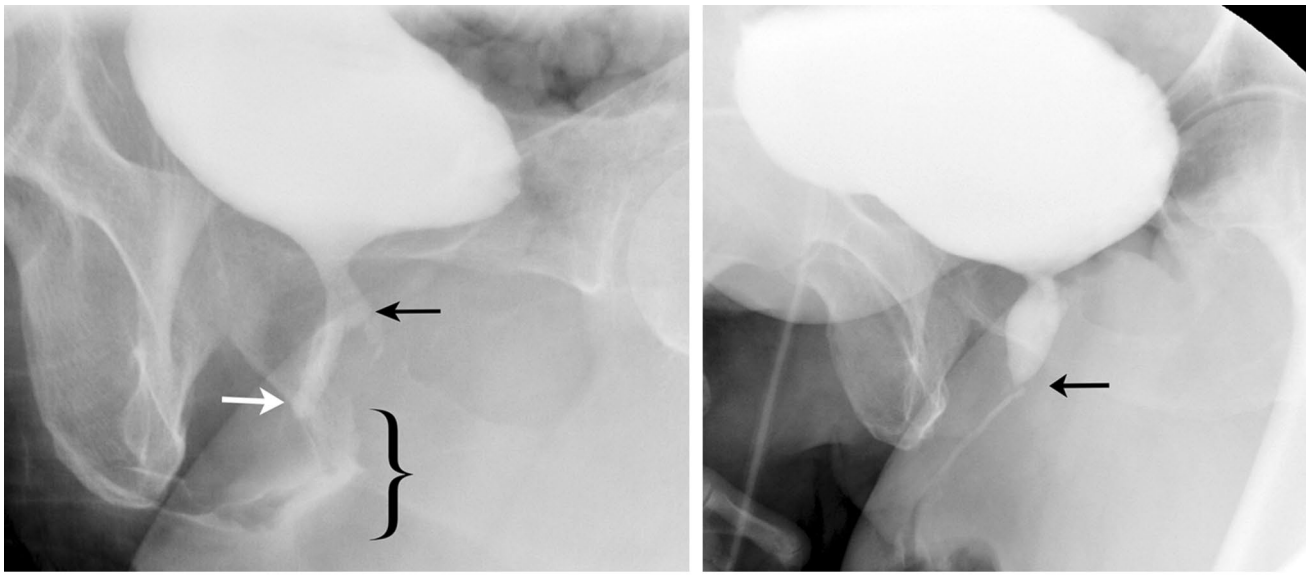

Fig. 9 Neourethral complications. **a** Recurrent urethrovaginal fistula, post repair: A 47-year-old patient with remote male to female gender reassignment surgery, with history of urethrovaginal fistula status post repair with buccal mucosal graft and gracilis flap with recurrent fistula. Cystourethrogram demonstrates contrast outlining urethra (white arrow), with a small contrast-filled fistulous tract extending posteriorly towards the neovagina (black arrow), in keeping with urethrovaginal fistula. Small amount of contrast is seen outlining neovaginal canal (open bracket). **b** Bulbar urethra stricture: A 67-year-old patient who underwent male to female gender reassignment surgery many years ago, presented with difficulty urinating. Cystourethrogram image demonstrates an area of tight narrowing at the level of bulbar urethra consistent with stricture (black arrow)

Long-term imaging appearance

Male to female

Long-term hormone therapy can lead to testicular atrophy in MTF patients. As MTF-GRS patients do not undergo prostatectomy, there is also a potential risk in these patients to develop prostate cancer, even though they may have a female phenotype. Hormonal supplementation with estrogen and spironolactone leads to an increase in breast tissue over many years with the formation of breast lobules; hence, cysts and fibroadenomas can also occur in these patients [22]. While breast cancer in MTF patients is quite rare, it may develop, especially if they have been on hormonal therapy for more than five years. Consequently, annual screening mammography is recommended in transgender women > 50 years old with a history of past or current hormone use [23]; however, this recommendation is primarily based on anecdotal experience. MTF patients undergoing breast augmentation are at no increased risk of breast cancer compared to natal females. Of note, a number of cases of implant-associated lymphoma have been reported both in natal females and MTF patients.

Female to male

Even though these patients have had a hysterectomy and salpingo-oophorectomy, a gynecological evaluation at least every 3 years is recommended. This is particularly the case for those FTM patients who retain their vagina (whether before or after further genital reconstruction); those with a strong family history of cancers of the breast, ovary, or uterus (endometrium); and those with a personal history of gynecological cancer or significant dysplasia on a Pap smear. Yearly chest wall and axillary examinations are recommended for screening in patients who have had bilateral mastectomy. For those with reduction mammoplasty or no surgery, breast examinations and screening mammography are recommended as for natal females [23].

Musculoskeletal findings

Bone age assessment

Gonadotrophin-releasing hormone analogues (GnRHas) are used to prevent/delay puberty in transgender adolescents before initiation of cross-sex hormone treatment in part to prevent the premature fusion of epiphyseal growth plates [24]. Transgender patients receiving GnRHas for the

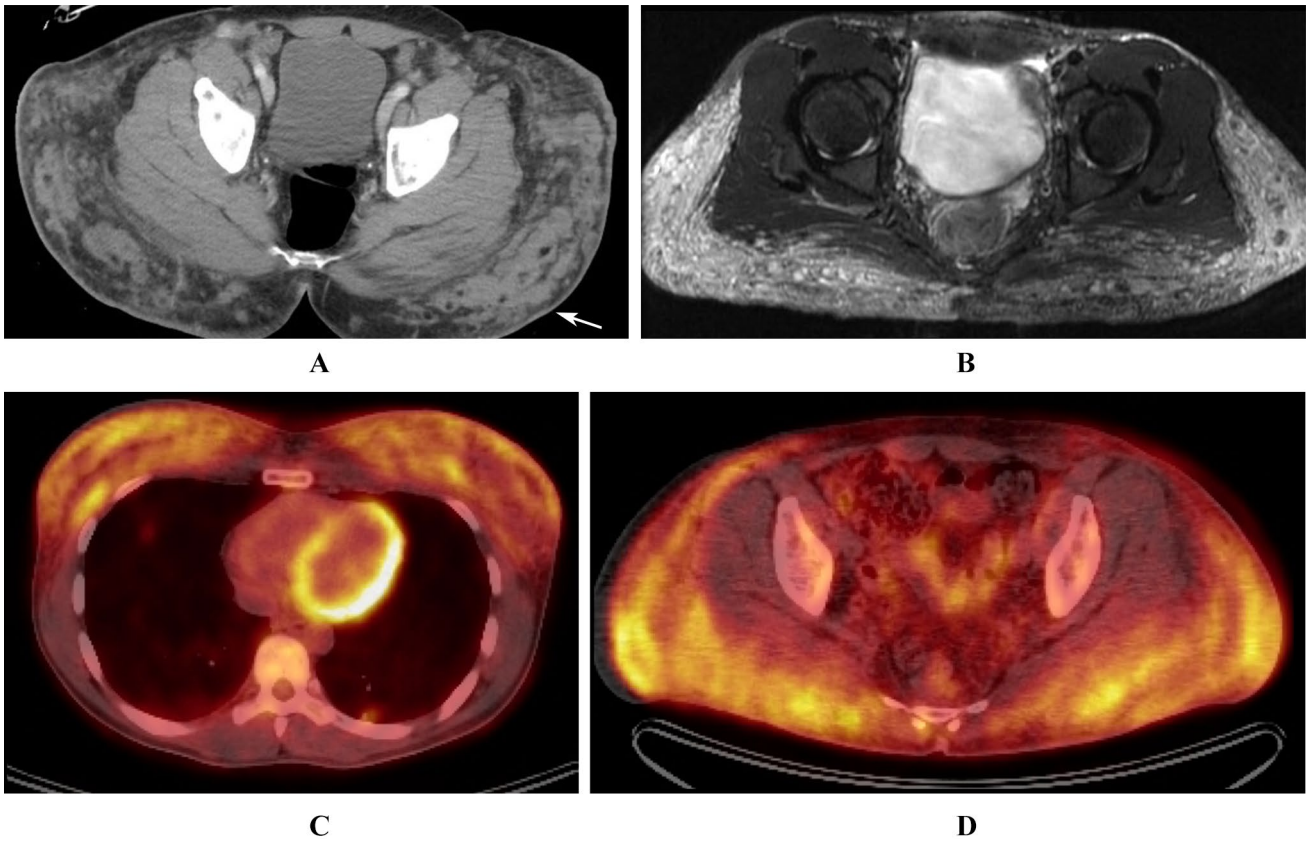

Fig. 10 Silicone granulomas in a male to female patient. **a** Axial contrast-enhanced CT shows multiple hyperdense subcutaneous nodules (white arrow). **b** Axial STIR MRI images demonstrate high signal subcutaneous nodules in the buttocks bilaterally (white arrow). Male to female transgender patient with history of silicone injections in breasts (**c**) and gluteal region (**d**). Diffuse FDG uptake in the soft tissues of the breasts and gluteal soft tissues is consistent with silicone injections

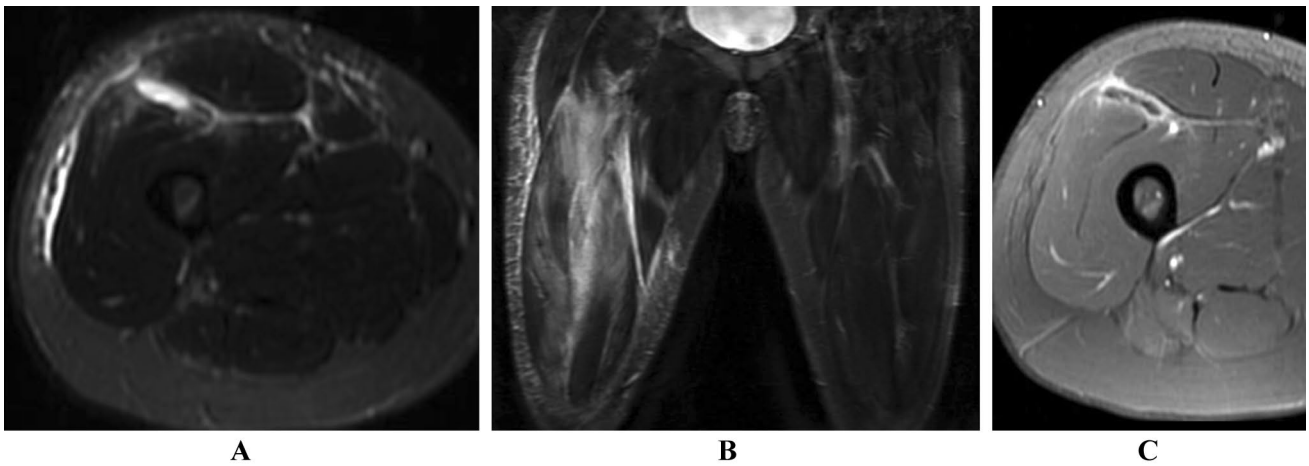

Fig. 11 Female to male patient with history of intramuscular testosterone injections. High STIR signal (**a**, **b**) on axial and coronal planes and enhancement on axial T1W images (**c**) within anterior compartment fascial planes of right thigh with small fluid collection within the fascia between the rectus femoris and vastus lateralis muscles, consistent with pyomyositis

suppression of puberty should therefore be monitored for adverse effects such as suppression of the normal growth spurt. For this reason, the Endocrine Society recommends serial left hand radiographs every 1–2 years until skeletal maturity [25].

Bone density

Little data are available on the effects of GnRHas on bone mineral density/bone mass (BMD). One study found that the use of GnRHas in gender dysphoria patients resulted in a statistically significant decrease in BMD in transgender females and a non-statistically significant trend for a decrease in BMD in transgender males [26]. It is likely that clinical effects of GnRHas are similar to those of constitutionally delayed puberty with one paper finding no significant decrease in BMD in natal men [27] and another reporting decreased BMD in the femoral necks [28]. A systematic review performed on behalf of the Endocrine Society in 2017 reviewed the available evidence for the effect of sex-steroid use on bone health in transgender patients [25]. They found no statistically significant difference in BMD at 12 or 24 months after initializing masculinizing therapy in transgender males. In transgender females, there was a statistically significant increase in BMD following initiation of feminizing hormone therapy. In theory, the adverse effects of GnRHas on BMD therefore could be reversed with sex hormone administration; however, at least one study has shown incomplete restoration [26].

Tendon rupture

Tendinopathy related to GnRHa use has not been reported. The relationship between tendon injuries and gender is complex due in part to different patterns of activity and injury. Nonetheless, part of the gender difference in tendon and ligament injury rates is thought to be related to sex hormone differences. Higher levels of estrogen are likely protective as estrogen promotes collagen synthesis in tendons [29]. Testosterone can result in increased stiffness in the tendon due to increased collagen turnover and there are case reports of increased rates of tendon and ligament tears with the use of synthetic testosterone derivatives and in the setting of high testosterone levels [30, 31].

Imaging pitfalls

It is important to be aware of certain pitfalls in the GRT patient population (Table 2). Patients may present years after their gender reassignment surgery with imaging often performed to determine the cause of pain or other unrelated abdominal symptoms with no provided history of gender reassignment. It is important to be aware that natal internal pelvic organs may be left in situ and their presence should not be misdiagnosed. CT or MRI may show a pelvic mass in a patient with external genitalia of a male. Absence of prostate and seminal vesicles should alert the radiologist about the possibility of a FTM transgender patient who may not have undergone hysterectomy or oophorectomy, to avoid misdiagnosing the native uterus and ovaries or benign uterine or ovarian masses as a pelvic malignancy (Fig. 12).

Similarly, with no history of gender reassignment, a neovagina posterior to the prostate can be misdiagnosed as an abscess or fluid collection. Similarly, a prostate can be misinterpreted as a pelvic mass in a MTF patient if careful attention is not paid to the anatomical origin of the mass (Fig. 12d). Additionally, patients may develop disease specific to their natal internal pelvic organs if left in situ. Specifically, a phenotypic female patient may present after

Table 2 Summary of imaging pitfalls and common complications to be aware of after gender reassignment therapy

A. Key imaging pitfalls

- Patients may present many years after gender reassignment surgery with imaging performed for unrelated underlying conditions (e.g., abdominal pain related to appendicitis)
- Imaging may be performed with no provided history of gender reassignment
- Natal internal pelvic organs may be left in situ and their presence should not be mistaken for a pathologic mass (e.g., a benign uterine mass should not be misdiagnosed with a pelvic malignancy in a FTM patient)
- Conversely, patients may develop disease specific to their natal internal pelvic organs if left in situ (e.g., prostate cancer in a MTF patient)

B. Common complications to be aware specific after gender affirmation therapy

- Male to female
  - Neovaginal fistulae or stenosis
  - Urethral stenosis
  - Bowel ischemia (neovagina)
  - Silicone granuloma formation
  - Thromboembolic complications secondary to estrogen replacement
- Female to male
  - Urethral stenosis
  - Testicular prothesis expulsion or displacement
  - Pyomyositis secondary to intramuscular testicular injections
  - Tendon and ligament tears secondary to high testosterone levels

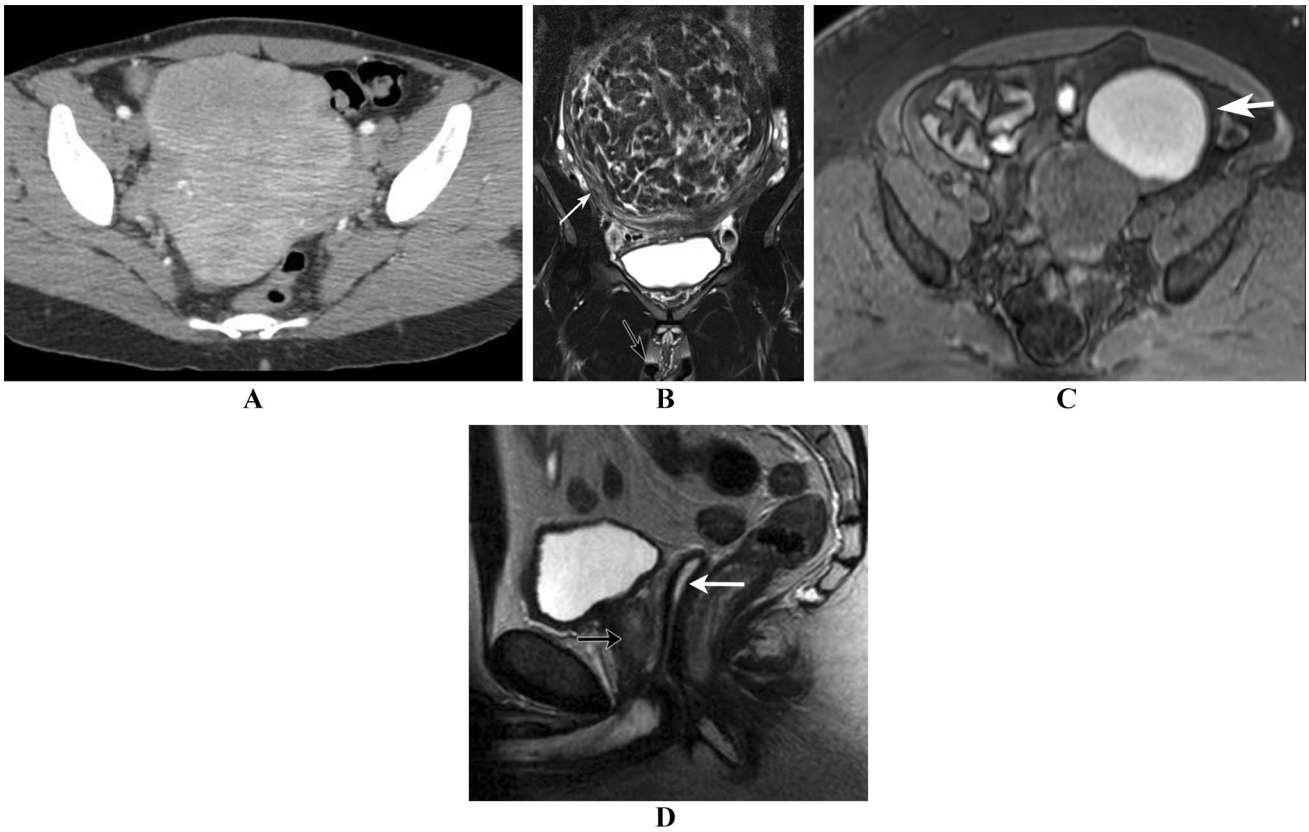

Fig. 12 Pitfalls in imaging of transgender patients. **a** Transgender female to male patient presents with pelvic pain and palpable mass. CT demonstrates uterus with a large lobulated infiltrative mass at the fundus, initially concerning for malignancy versus fibroid. Pathology post hysterectomy showed large fibroid and background adenomyosis. Coronal T2W FS MRI (**b**) demonstrates uterus with a large uterine mass (white arrow), likely a fibroid. Flow voids from scrotal expanders are seen in the perineum of the coronal image (black arrow). **c** MRI performed to evaluate for pelvic pain shows T1 hyperintense mass in left adnexa in a female to male transgender, consistent with endometrioma (white arrow). **d** MRI performed to evaluate "pelvic mass in a female patient seen on prior CT." The "mass" corresponds to atrophic prostatic tissue (black arrow). Neovagina (white arrow) is demonstrated posteriorly, as seen on sagittal T2W MRI image

gender affirmation surgery without prostatectomy with prostate disease. Awareness of this will prevent avoiding missing a prostate cancer diagnosis.

Cultural sensitivity

It is prudent to be sensitive to this patient population as they are often subject to stigma, discrimination, and bias leading to decreased utilization of healthcare resources. Correct terminology and use of preferred pronouns demonstrate understanding and genuine care for this patient population. Even the recognition and use of the term "gender affirmation surgery" instead of "gender reassignment surgery" carries more empathy and compassion for the people electing to undergo this surgery in that it recognizes the alteration of their phenotype to make it congruent with how they feel. Appropriate education and training of radiology faculty and staff will help create a positive experience with the department of radiology. Special accommodations (such as being first case of the day) can be offered for transgender male patients presenting for pelvic ultrasound in offices that are scanning women only.

Conclusion

With increasing awareness of gender dysphoria and number of patients undergoing gender reassignment surgeries, it is crucial for radiologists to be aware of common

surgeries, their associated complications, and their imaging appearances.

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Compliance with ethical standards

Conflicts of interest The authors of this article declare that they have no conflicts of interest to disclose.

Ethical approval This article does not contain any studies with human participants or animals performed by any of the authors.

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