

# Injury in the transgender population: What the trauma surgeon needs to know

Shane D. Morrison, MD, MS, Sarah M. Kolnik, MD, Jonathan P. Massie, MD, Christopher S. Crowe, MD, Daniel Dugi, III, MD, Jeffrey B. Friedrich, MD, Tam N. Pham, MD, Jens U. Berli, MD, Grant E. O'Keefe, MD, MPH, Eileen M. Bulger, MD, Ronald V. Maier, MD, and Samuel P. Mandell, MD, MPH, Seattle, Washington

**ABSTRACT:** Gender dysphoria, or the distress caused by the incongruence between a person's assigned and experienced gender, can lead to significant psychosocial sequelae and increased risk of suicide (>40% of this population) and assault (>60% of this population). With an estimated 25 million transgender individuals worldwide and increased access to care for the transgender population, trauma surgeons are more likely to care for patients who completed or are in the process of medical gender transition. As transgender health is rarely taught in medical education, knowledge of the unique health care needs and possible alterations in anatomy is critical to appropriately and optimally treat transgender trauma victims. Considerations of cross-gender hormones and alterations of the craniofacial, laryngeal, chest, and genital systems are offered in this review. Further research on the optimal treatment mechanisms for transgender patients is needed. (*J Trauma Acute Care Surg.* 2018;85: 799–809. Copyright © 2018 Wolters Kluwer Health, Inc. All rights reserved.)

**KEY WORDS:** Trauma; transgender; venous thromboembolism; surgical considerations.

Gender dysphoria results in significant distress from the incongruence of one's gender identity with their anatomy (Table 1).<sup>1–3</sup> For transgender individuals, this can result in severe psychosocial sequelae and increased risk of suicide and assault.<sup>4,5</sup> In fact, it has been reported that more than 40% of gender dysphoric individuals have attempted suicide while more than 60% have experienced physical or sexual violence.<sup>6</sup> Discrimination and prejudice prevented many transgender individuals from obtaining benefits from the public sector, including equitable access to health care and employment. Societal awareness and greater acceptance of transgender issues have alleviated some of the discrimination, but difficulties continue to remain significant, especially within health care.<sup>4,5,7–18</sup> Most providers have no training on the aspects of health care delivery specific to transgender patients.<sup>16–23</sup>

Recent estimates of the transgender population place it, conservatively, at 25 million people worldwide and 1 million people within the United States.<sup>4,24</sup> Multiple studies illustrate

the significant improvement that gender affirmation can have on psychosocial sequelae and quality of life for those with gender dysphoria.<sup>2,7,9,11,25–38</sup> The World Professional Association for Transgender Health develops standards of care for the treatment of transgender patients and has made recommendations that should be met before medical or surgical gender affirmation.<sup>9,28</sup>

Gender affirmation generally begins with a mental health assessment followed by initiation of cross-gender hormones or pubertal blocking agents.<sup>9</sup> Gender-affirming surgical procedures generally require these steps to be taken, but facial and vocal pitch elevation surgeries currently have no preoperative hormone or assessment requirements.<sup>35,39</sup> For male-to-female (or transwoman) transgender patients, options for gender-affirming surgery consist of facial feminization, vocal pitch elevation, chest feminization, body contouring, and genital surgery.<sup>9,35</sup> For female-to-male (or transman) transgender patients, options for gender-affirming surgery consist of facial masculinization, chest masculinization, body contouring, and genital surgery.<sup>32,40</sup> Techniques and outcomes are being explored throughout plastic surgery, urology, and gynecology literature; but there is minimal information available within the general surgery literature, especially trauma literature, on management of transgender patients.<sup>9,37,41,42</sup>

Trauma is a significant cause of morbidity and mortality, particularly for people younger than 45 years of age. As transgender patients are more likely to be victims of assault and intimate partner violence (>60% of population) or suicide (>40% of population), they are at increased risk for traumatic injury.<sup>6</sup> In addition, as societal acceptance continues to improve for transgender individuals and insurance coverage expands for gender-affirmation procedures, the visibility and prevalence of transgender individuals will also increase in the general trauma population. Trauma surgeons and providers caring for these injured patients must be prepared to recognize their unique needs and respond in the

Submitted: June 24, 2017, Revised: August 2, 2017, Accepted: August 9, 2017, Published online: February 27, 2018.

From the Division of Plastic and Reconstructive Surgery, Department of Surgery, University of Washington School of Medicine, Seattle, Washington (S.D.M., C.S.C., J.B.F.), Division of Trauma, Critical Care, and Burn, Department of Surgery, University of Washington School of Medicine, Seattle, Washington (S.M.K., T.N.P., G.E.O., E.M.B., R.V.M., S.P.M.); Division of Plastic Surgery, Department of Surgery, Feinberg School of Medicine, Northwestern University, Chicago, Illinois (J.P.M.); Department of Urology, Oregon Health & Sciences University, Portland, Oregon (D.D.), and Division of Plastic and Reconstructive Surgery, Department of Surgery, Oregon Health & Sciences University, Portland, Oregon (J.U.B.).

Address for reprints: Samuel Mandell, MD, MPH, FACS, Division of Trauma, Critical Care, and Burn, University of Washington Department of Surgery, Harborview Medical Center, 325 9th Avenue, Mailstop #359796 Seattle, WA 98104; email: mandells@uw.edu.

DOI: 10.1097/TA.0000000000001859

*J Trauma Acute Care Surg*  
Volume 85, Number 4

**TABLE 1.** Definitions the Trauma Surgeon Should Know

Term	Definition
Sex	Assigned at birth from anatomy of external genitalia (i.e., male, female)
Gender identity	Intrinsic sense of gender (i.e., masculine, feminine) that can be congruent or incongruent with sex. Can be outside normative binary of masculine and feminine.
Gender dysphoria	Significant distress caused by discrepancy between assigned sex and gender identity. This is not a pathologic state.
Gender nonconforming	Identity or expression of gender that differs from cultural norms and falls outside of binary understanding of masculinity and femininity
Transgender	Diverse group of people that transcend defined categories of gender, with their gender identity differing in varying degrees from sex
Nonbinary	Diverse group of people who do not identify their gender along the binary categories of male and female, but a combination of both or neither.
Transsexual	Outdated term previously used in surgical literature to denote a transgender person who was undergoing surgical procedures for gender affirmation.
Cismale/Cisman or cisfemale/ciswoman	A person whose gender identity is congruent with their assigned sex (i.e., they were born female and express their gender as female)
Transmale/Transman	A person who was assigned female sex at birth and identifies with the male gender (i.e., female-to-male)
Transfemale/Transwoman	A person that was assigned male at birth and identifies with the female gender (i.e., male-to-female)
Transition	Period of social and possibly medical transition between sex assigned at birth and gender identity
Gender-affirmation surgery/Gender-confirming surgery	A set of surgical procedures to assist in the transition of a person in the setting of gender dysphoria. Formerly referred to as “sex reassignment surgery” or “gender reassignment surgery,” but these are antiquated and can be oftentimes considered derogatory.

emergency setting. In this article, we review and evaluate the available literature on the care of transgender patients in the trauma setting. Recommendations on the management of transgender patients are offered based on the experience of the authors managing transgender patients at trauma centers with a large transgender population. Lastly, recommendations on future research are discussed due to the paucity of current evidence-based practice.

## METHODS/RESULTS

A comprehensive literature search for transgender patient populations within the context of trauma and general surgery was completed using PubMed to search the MEDLINE database. Medical subject headings included “trauma” OR “injury” AND “transgender/transsexual”, in addition to “surgery” AND “transgender”. The search categories were intentionally left broad in an effort to capture all articles published from January 2000 to May 2017. Titles, abstracts, and full texts were screened and articles, case studies, commentaries, or reviews were selected based on their relevance to the topic of inquiry.

A total of 388 articles were identified with these search terms. Of these articles, 382 were excluded due to a lack of relevance to acute care surgery or physical trauma/injury. The six remaining articles consisted of one review of general surgery care for the transgender patient, one commentary highlighting the paucity of information regarding acute care surgery for transgender patients, and four case reports identifying unique general surgery issues specific to transgender patients.<sup>9,43–47</sup> No articles were identified that addressed trauma/injury from

the perspective of caring for the injured transgender patient. Due to the paucity of data, and as mentioned in the introduction, recommendations are based largely on the experience of the authors managing transgender patients at trauma centers with a large transgender population.

## DISCUSSION

### Gender-Affirmation Interventions: A Primer

#### Hormonal Therapy

Medical gender affirmation with cross-gender hormones is often started before any surgical gender affirmation, and can be used independently of surgery.

#### Transwomen

Hormonal options include exogenous estrogen or progesterone, androgen blockers (spironolactone, finasteride, and dutasteride), and gonadotropin-releasing hormone analogs (GnRHa). The goals of medical therapy include female fat redistribution, decreased muscle mass, breast growth, lessening of body and facial hair, and cessation of male pattern baldness.<sup>9,48</sup> Exogenous estrogen (oral, transdermal, or intramuscular) can have a significant impact on the development of venous thromboembolic (VTE) events (5–10% lifetime risk) and derangements of liver function tests.<sup>48</sup> There is some literature to suggest that patients on intramuscular estrogen may have less of a risk of VTE due to absence of first pass effect.<sup>48</sup> Spironolactone can be taken in levels of 200 mg to 400 mg per day until orchiectomy, and if this intervention is pursued, can lead to significant electrolyte abnormalities, including hyperkalemia.<sup>48</sup> Gonadotropin-releasing

hormone analogs are used for pubertal suppression in the adolescent population to decrease the development of secondary sexual characteristics and increases the risk of VTE and myocardial infarction. Smoking compounds the risk of VTE with hormones and GnRHa.<sup>48</sup>

### **Transmen**

Hormonal options available are exogenous testosterone and GnRHa. The goals of medical therapy include increased facial and body hair, increased muscle mass, male fat distribution, acne, cessation of menses, deepening of voice, and clitoral enlargement.<sup>9,48</sup> Exogenous testosterone (oral, gel, transdermal, cream, and axillary) can lead to development of polycythemia in up to a quarter of patients, exacerbation of obstructive sleep apnea and osteoporosis, abnormal liver function test results, and reduction of high-density lipoprotein. Gonadotropin-releasing hormone analogs function similarly in transmen as in transwomen.<sup>48</sup>

### **Craniofacial Surgery**

During facial gender-affirming surgery, there are various procedures that transgender patients may undergo to feminize or masculinize their face.<sup>39</sup>

#### **Transwomen**

Procedures to feminize the face are more common and consist of alterations through decreasing temporal alopecia, reduction of supraorbital bossing/ridge, widening of the orbits, decreasing the size and producing a more concave dorsum of the nose, softening the angles of the mandible, widening and advancing the cheeks, narrowing the chin, and reducing the thyroid cartilage projection.<sup>35</sup> Many of these procedures require fracturing of the craniofacial bones and subsequent plating following movement or skeletal alteration. Other procedures, like laryngeal chondroplasty or rhinoplasty, can affect the cartilaginous support structure of the nose and trachea.

Pitch alteration surgery is an option that some transwomen opt to pursue to raise the fundamental frequency of the voice for vocal feminization. This is an infrequently pursued procedure relative to voice therapy, but up to 16% of transwomen desire it according to the 2015 Transgender Survey (<http://www.ustranssurvey.org/>). Common techniques include cricothyroid approximation, endoscopic vocal cord shortening, and laser reduction of the vocal cords.<sup>49,50</sup> In cricothyroid approximation, the thyroid and cricoid cartilages are approximated together with sutures to minimize the distance between them. In vocal cord shortening techniques, sutures can be placed between the cords to bring them in closer or lasers can be used to encourage adjacent vocal cord edges to heal together. Speech therapy is more commonly pursued by transwomen.<sup>51</sup>

#### **Transmen**

Procedures to masculinize the face generally consist of placement of implants to augment the craniofacial skeleton and are pursued far less often than those to feminize the face. These require less skeletal manipulation, but do necessitate placement of foreign bodies or autologous cartilage, which are at risk of displacement.<sup>52,53</sup>

### **Chest/Body Surgery**

Before undergoing chest surgery, some surgeons and insurance companies require 1 year of cross-hormonal therapy,

but this is not required per the World Professional Association for Transgender Health Standards of Care Version 7.<sup>28</sup>

#### **Transwomen**

Transwomen on hormones achieve some breast growth; however, usually, it remains an underdeveloped breast. If further enhancement is desired, chest feminization consists of fat grafting and breast augmentation with saline or silicone implants (Fig. 1).<sup>54</sup> There are rare case reports of transwomen undergoing free flaps for breast construction, with the deep inferior epigastric artery perforators being connected to the internal mammary arteries.<sup>55</sup>

#### **Transmen**

Chest masculinization consists of subcutaneous mastectomy with recreation of the nipple areolar complex through various routes depending on the size of the original breasts (Fig. 1).<sup>56,57</sup> Many transmen will bind their breasts if they have not had mastectomy.

Body contouring in either transmen or transwomen generally consists of excision of tissue or liposuction and fat grafting but can also come in the form of implants throughout the body (pectoral, calf, biceps, and buttocks).

### **Genital Surgery**

For genital gender-affirming surgery, procedures usually come in the form of removal of sexual organs and creation of genitalia congruent with the patient's gender identity. However, as with many gender-affirming interventions, transgender individuals may elect not to pursue these interventions; in fact, it is often that genital surgery is not pursued due to lack of available providers, cost, inadequacy of current procedures, or patient's preference.<sup>4,5</sup>

#### **Transwomen**

Surgical castration with orchiectomy and vaginoplasty to create a neovagina can be combined or done in stages. If penile inversion vaginoplasty is pursued, orchiectomy is done at the time of vaginoplasty as the scrotal skin can be used to increase vaginal depth by placing it at the end of the inverted penile skin.<sup>58</sup> Intestinal vaginoplasty using the rectosigmoid colon is a less common method, useful particularly in patients with a prior penectomy or those with insufficient penile length from pubertal suppression or other reasons.<sup>33,59,60</sup> The dissection plane for the neovagina occurs between the rectum and prostate. The neoclitoris is derived from the glans penis on its neurovascular bundle and outer labia are created from scrotal skin (Fig. 2). Minor wound healing complications and granulation tissue formation are common in the early postoperative period. Major complications are rare (<10%) and include rectovaginal fistulas, urethral injuries, vaginal stenosis, or hematoma requiring operative drainage.<sup>33,58</sup>

#### **Transmen**

Surgical removal of sexual organs and genital reconstruction are generally staged. Hysterectomy and bilateral salpingo-oophorectomy are completed before genital reconstruction, as combined procedures have increased blood loss and need for transfusion.<sup>61</sup> A distinct population of transmen may elect to only pursue removal of female sexual organs, so presence of a phallus in a transman should not be assumed. Genital reconstruction consists of metoidioplasty (hormonal enlargement



**Figure 1.** Chest surgery in transmen and transwomen. A, Transman before chest masculinization. B, Two months after chest masculinization. C, Transwoman before breast augmentation; she has been on exogenous estrogen for more than 2 years. D, Two months after breast augmentation. E, Transwoman before breast augmentation (this patient was on estrogen and previously had silicone injections into her breasts). F, Two months after breast augmentation. Photos courtesy of Jens Berli, MD (OHSU), and he retains their copyright.

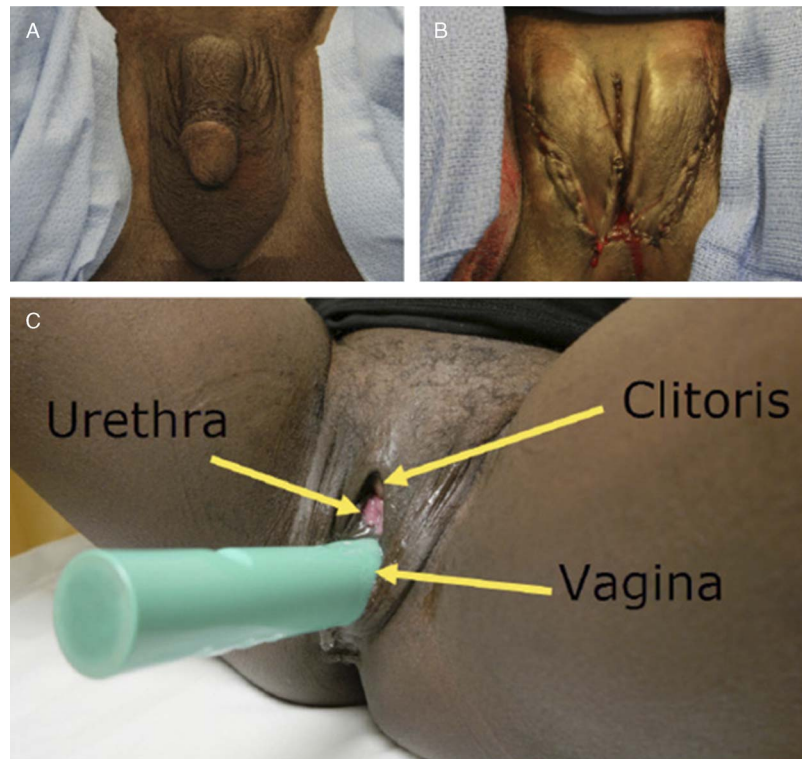
and surgical relocation of the clitoris possibly with urethral lengthening from labial tissue to form a microphallus) or phalloplasty (creation of a neophallus) with concomitant scrotoplasty and vaginectomy. Metoidioplasty relies on clitoral hypertrophy due to exogenous systemic hormones followed by creation of a microphallus through local rearrangement of tissue including lengthening of urethral tissue to the tip of the microphallus (Fig. 3). Erogenous and tactile sensations are retained, as the dorsal clitoral nerves and ilioinguinal nerve remain intact. Urethral complications, notably urethrocutaneous fistula, remain the most common.<sup>61–63</sup>

Phalloplasty consists of creation of an anatomic phallus that has tactile and erogenous sensation, and can be used for standing micturition and penetrative sexual intercourse if a penile implant or autologous bone as part of the phalloplasty composite flap were placed. Pedicled and free flaps are used most frequently with the neourethra and neophallus created in a single flap from a tube-in-tube formation (Fig. 4).<sup>34</sup>

The radial forearm free flap is the most commonly used but requires microsurgery for vessel anastomosis to branches

of the superficial femoral artery or deep inferior epigastric artery and saphenous vein. When the femoral artery is used, then often an AV fistula from the saphenous vein is created to ensure adequate vessel length. Nerves are also coapted to give erogenous and tactile sensation (medial and lateral antebrachial cutaneous nerves to one of the dorsal clitoral nerves and the ilioinguinal nerve). The donor site of the forearm is skin grafted for closure (Fig. 4).<sup>31</sup> The anterolateral thigh can be used as a pedicled or free flap but is mostly used as a pedicled flap due to close proximity to the groin. For sensation, the lateral femoral cutaneous nerve is coapted to the dorsal branch of the clitoral nerve or ilioinguinal nerve. This flap has more girth than the radial forearm, so can lead to more vascular compromise with tubularization.<sup>31,34,64</sup> Both flaps come with significant risks of urethral complications (>30%), mainly including urethral fistula and stricture.<sup>34</sup> When tissue is used from the vaginectomy for extra urethral coverage, this reduces chances of urethral fistulas and strictures.<sup>65</sup> Other options for phalloplasty include a fibula osteocutaneous flap, abdominal based flaps, latissimus dorsi musculocutaneous flaps, and groin flaps with the inclusion of iliac bone.<sup>40</sup> Some





**Figure 2.** Vaginoplasty in transwomen. A, Preoperative photo before penile inversion vaginoplasty. B, Immediately postoperative. C, Four months postoperative with arrows identifying the vaginal canal, urethra, and clitoris. Photos courtesy of Daniel Dugi III, MD, FACS (OHSU), and he retains their copyright.

centers offer an alternative to autologous tissue transfer in the form of penile epithesis, or implantation of metal rods into the pelvis for securing of a penile prosthetic.<sup>34,40</sup>

Patients may also keep their vagina for sexual gratification in which case the urethral anatomy remains native. Either to avoid urethral complications or due to intractable urethral complications, some patients may have a perineal urostomy underneath their neoscrotum. This is important to know in the setting of an acute trauma, as catheterization from the glans is not possible. Scrotoplasty is completed by inferior release and superior rotation of the labia majora.<sup>66</sup>

Eventually, testicular and penile implants can be placed after surgery, but this usually relies on the development of tactile sensation of the phallus. Penile implants come in two forms: malleable and inflatable. The malleable prostheses are inserted into the penile shaft and can be molded into a straight or curved

orientation to recapitulate an erect or flaccid penis. The inflatable prostheses are more complex to insert due to the presence of a pump and valve. The pump is inserted into one hemiscrotum and the reservoir in the retroperitoneal space. These can be inflated to simulate an erect penis.<sup>40</sup> Complications of penile implant placement such as infection, extrusion, mechanical failure, or displacement due to absence of a tunica albuginea for reliable attachment to the pubic rami can be as high as 50%.<sup>67,68</sup>

### Considerations for Trauma Evaluation of Transgender Patients

#### Initial Encounter

During surgical consultation, it is important to be aware that many transgender patients may have limited or negative prior interactions with general health care providers due to the



**Figure 3.** Metoidioplasty in transmen. A, Preoperative photo after exogenous systemic testosterone. B, Immediately postoperative. C, Three months postoperatively with scrotoplasty, but awaiting testicular implants. Photos courtesy of Daniel Dugi III, MD, FACS (OHSU), and he retains their copyright.



**Figure 4.** Phalloplasty in transmen. A, Preoperative photo before phalloplasty in a transman. The outline of flap positioning is drawn along with the planned incision for vessel and nerve access. B, Immediately postoperative from glansplasty and scrotoplasty for radial forearm tube-in-tube phalloplasty showing the ventral phallus and scrotum created from the labia. C, Immediately postoperative from glansplasty and scrotoplasty for radial forearm tube-in-tube phalloplasty showing the dorsal phallus. D, One month postoperative from radial forearm tube-in-tube phalloplasty with suprapubic catheter still in place. E, Two months postoperative from radial forearm phalloplasty with view of neourethra. F, Radial forearm skin graft scar 2 months postoperatively. Photos courtesy of Jens Berli, MD (OHSU), and he retains their copyright.

significant discrimination this population faces. Establishing patient-provider trust is invaluable to ensuring delivery of appropriate and optimal care and becoming a patient ally. The patient's gender identity and appropriate pronouns/names are critical to discuss, not assume, and it will often be important to determine sexual orientation as well.<sup>46</sup> This information is sensitive and personal, and the patient should be asked with whom it may be shared. The stages of transition should be explored to determine if the patient is on hormones or has undergone gender-affirming surgery.

Of note, even if a patient identifies as transgender, they may not have undertaken or had access to medical or surgical therapy, so these should not be assumed. All transgender patients should be afforded the same treatment regardless of their stage of gender affirmation. Affirming actions for all transgender patients

should include respectful questions about their gender identity ("what is your gender identity?"), their preferred name ("what is your preferred name?"), and their preference for pronouns ("what pronouns would you like me to use?"). In some instances, these responses may not match information on their government identification, insurance cards, or information from family members. Clues to guide providers to consider possible transgender identity can include cross-sex clothing or underwear, makeup, breast binding, or phallus "tucking."

It is important to note the type of providers that have assisted in gender affirmation as stigma may have led them to seek health care outside of traditional providers, including non-prescription hormones and silicone injections (where silicone is injected subcutaneously to simulate an implant or augment tissue volume). Nonmedical interventions can come with significant

complications, so it is important to explore these with the patient and, if possible, ensure they are offered the opportunity to see licensed medical providers for further assistance with gender affirmation.

Transgender patients may have significant dysphoria associated with their preoperative genitals. Examination for injury to the genitalia may be extremely stressful, and involvement of providers experienced with examination of transgender patients should be sought, if possible. A single examination with the various providers should be done, if possible, to ensure privacy and reduce patient's distress.

As for other populations at high risk of assault or violence, all injured transgender patients should be screened for safety within intimate relationships, possible sexual abuse, or self-harm. High rates of intimate partner violence exist within the LGBT community, with the highest rates existing for transgender individuals. One study found that transgender persons had a lifetime prevalence of physical abuse of 34.6% compared to 14% for same-sex couples.<sup>69</sup> Although not specific to cohabitant relationships, reports of sexual violence in the transgender community ranged from 14% to 53.6%.<sup>70,71</sup> Currently, there is no intimate partner violence screening tool specific to the transgender community. A recent systematic review of screening tools for intimate partner violence found no tools that had well-established psychometric properties. Further testing and standardization were recommended to be undertaken for improved detection of intimate partner violence in the transgender community.<sup>72</sup>

Health maintenance examinations should be discussed after the immediate health care needs are addressed and include vaginal or neovaginal examination with possible Papanicolaou test if a transman retained his female sexual organs, colonoscopy for intestinal vaginoplasties, prostate examination for transwomen, and evaluation of implants (breast, testicular, penile, etc.).

If the patient is encountered in the trauma setting where they are unable to communicate, it will be important to establish as much information as possible from the medical record and primary care provider or family/friends. However, as previously mentioned, one must be careful when discussing gender identity, as the patient may not want this revealed and family may be unaware of patient's desired gender identity or transition. Important considerations for evaluations of acute injuries in the trauma setting are discussed below.

## Primary Survey

### Airway

**Transwomen.** For transwomen, establishing an airway may offer difficulty from modifications to the craniofacial skeleton and vocal cords. Endoscopic shortening of the vocal cords may increase the difficulty of intubation. While this should not impede acute intubation, it may alter the appearance of the vocal cords due to scarring. It is possible a smaller endotracheal tube may be needed due to narrowing of the glottic space. Intubation injury may negatively affect a transwoman's pitch. Cricothyroid approximation drastically reduces the available area for a cricoidotomy, and one should be aware that sutures might have to be removed between the thyroid and cricoid cartilages. Manipulation of tissue planes to the trachea may have been

modified with laryngeal chondroplasty. Manipulation of the craniofacial skeleton in facial feminization can increase the risk of craniofacial fractures, which could lead to difficulty in airway establishment.

**Transmen.** Manipulation of the thyroid cartilage with implants may obscure tissue planes in the setting of an emergent cricoidotomy or other surgical airway. Implants may distort anatomic landmarks and scar tissue may make it challenging to identify where to proceed.

### Breathing

**Transwomen.** In the setting of respiratory failure, it is important to consider the increased likelihood of a venous thromboembolism from estrogen hormone therapy, especially in the setting of trauma and immobility.<sup>48</sup>

**Transmen and Transwomen.** Chest implants may have been used in the process of body contouring. This should be considered when evaluating breath sounds in the trauma bay.

### Circulation

**Transwomen.** Exogenous estrogen may also increase blood volume in transwomen.<sup>73</sup>

**Transmen.** If arterial blood is needed and a patient has had a radial forearm phalloplasty, then the radial artery will not be available. The arm affected by this will likely be recognizable due to a skin graft scar (Fig. 4). The opposite arm should be used for arterial draws when possible.

In patients with significant hemorrhage where resuscitative endovascular balloon occlusion of the aorta is being considered, the surgeon should be aware that accessing the femoral vessels might compromise the neophallus if a free flap phalloplasty was performed. Extreme cases of pulmonary failure or hypothermia may require extracorporeal membrane life support where the femoral vessels may also need to be accessed. This should not prevent initiation of these life-saving therapies, but awareness of the possible changes in vascular anatomy of the femoral system is necessary to prevent harm. Oftentimes, the phallus is vascularized from the femoral system contralateral to the donor arm and can aid the surgeon in determining which femoral vessels to access.

## Secondary and Tertiary Surveys

A full secondary and tertiary examination should include determination of the possible facial, chest, body, and genital procedures performed as part of gender affirmation (Table 2). In some instances, routine imaging studies performed in the evaluation of the patient may be the first clue for postoperative gender-affirming procedures, including the presence of implants or hardware. Clinicians must remain cognizant that a genital examination may cause significant distress in patients who are awake but not communicative due to possible dysphoria related to their genitals.

### Transwomen

There is a potential for increased risk of facial fractures due to craniofacial skeletal manipulation.<sup>35</sup> Breast implant rupture should be considered if breast augmentation occurred in the past but does not have acute implications and can generally safely be assessed in the outpatient setting. As with women



**TABLE 2.** Important Physical Exam Findings to Consider in Assessing Acute Injury in a Transgender Patient

Anatomical Region	Transman	Transwoman
Head and Neck	– Coronal or submental scar may suggest facial implant placement	– Coronal or submental scar may suggest previous manipulation of craniofacial skeleton or thyroid cartilage – Makeup may offer a clue of transwoman identity but should not be assumed
Torso	– Chest implants may be palpable – Circumareolar or subpectoral incisions may suggest chest masculinization – Breast-binding – Cross-gender clothing may offer a clue of transman identity, but should not be assumed	– Inframammary, peri-areolar, or axillary scars may suggest breast augmentation – Lower transverse abdominal scar with breast scars may suggest autologous breast reconstruction – Palpable implants or capsules may suggest implants or silicone injections – Midline or laparoscopic scars may suggest intestinal vaginoplasty – Phallus tucking may suggest transwoman identity, but should not be assumed – Cross-gender clothing may offer a clue of transwoman identity, but should not be assumed
Extremities	– Skin graft scars on the forearm or thigh may suggest phalloplasty – Longitudinal lateral lower leg scar may suggest fibula osteocutaneous phalloplasty	– None
Pelvis	– Inguinal crease scar may suggest site for neophallus anastomosis – Ventral penile openings may suggest urethrocutaneous fistula – Scrotal scars may suggest labia scrotoplasty – Midline perineal scar suggests previous vaginectomy – Rectal exam will not have a palpable prostate – Presence of a vagina indicates potential need for vaginal/pelvic exam and consideration for pregnancy – Consider palpation of penis and scrotum for implants	– Rectal or neovaginal exam will have a palpable prostate – Labial scars and epithelium within the vaginal canal suggests penile inversion vaginoplasty – Mucosal epithelium in vaginal canal suggests intestinal vaginoplasty

who have had breast reconstruction with autologous tissue, the pedicles for transwomen are medial by the internal mammary vessels, and the patient likely has a portion of the medial third and fourth ribs removed for anastomosis. This is important to know when interpreting radiologic imaging. When assessing the genitalia, penoscrotal inversion or intestinal vaginoplasty should be determined. Penoscrotal inversions have an increased risk of rectovaginal fistula and prolapse, while an intestinal vaginoplasty may be the source of a lower gastrointestinal bleed or additional location of perforated hollow viscous.<sup>33,58</sup> It will be important to determine if an endoscopic examination of the neovagina is needed. A rectal examination should be used to assess the prostate for possible urethral injury. Sometimes, palpation of the prostate may be facilitated through the neovagina if vaginoplasty has occurred; sufficient lubrication should be used if penoscrotal inversion vaginoplasty was completed, as the lining of the vaginal canal is skin epithelium. The prostate in transwomen on cross-gender hormones will often be very small. If a mass is felt at the prostate, then this should be noted as a need for follow-up with urology for possible prostate cancer. Due to the increased risk of venous thromboembolism, estrogen should be discontinued when admitted for trauma. No data exist on optimal time to restart therapy, but based on elective surgical literature, should be held for at least 4 weeks after trauma. Spironolactone initiation in lieu of hormones can be considered if the patient still has testicles. Low-molecular-weight heparin should be considered for chemoprophylaxis in transwomen if not contraindicated.<sup>74</sup> Consultation with endocrinology may be helpful in determining the appropriate timing to reinstate cross-gender hormones.

### Transmen

Those taking testosterone may have an increased risk of fractures from osteoporosis.<sup>48</sup> Implant rupture should be

considered if pectoral, calf, or other implants were placed. Some transmen retain their female sexual organs, so it is important to assess the genitalia when possible. If the female sexual organs are retained, consider potential injury to the fetus or pregnancy testing before imaging. Ruptured ectopic pregnancy and pelvic inflammatory disease could be sources of infection or intra-abdominal pathology. If the patient has a phalloplasty, the viability of the phallus should be assessed with clinical examination and possible arterial Doppler ultrasonography. The presence of penile and testicular implants should be assessed. If a urethral catheter is to be placed, then involvement of urology may be necessary. Before insertion of a urethral catheter, the phallus should be inspected for possible injury, scars, or presence of urethral fistula. Adequate lubrication should be used, as the neourethra will be composed of skin epithelium. Insertion of the catheter should not be forced if it does not slide easily, as the patient may have a urethral stricture. Urethroscopy may be needed for appropriate placement. Consideration of a suprapubic catheter is an option if there is trauma to the phallus or urethral pathology. Again, some patients may have a perineal urostomy underneath their neoscrotum, making placement of a urinary catheter via the phallus impossible. Transmen will also not have a prostate, so this should be expected on a rectal examination. Polycythemia may be a result of testosterone if aberrant laboratory results are present. Early consultation with plastic surgery, urology, or gynecology can assist with evaluation of genitals and other reconstructed areas.

### Involvement of Care Coordination Professionals

Transgender individuals comprise an at-risk population, carrying both a greater rate of interpersonal and self-inflicted violence compared to the general population.<sup>70,71,75,76</sup> With regard to an initial trauma evaluation, patients may present following physical assault, sexual assault, muggings and robbery, domestic



partner abuse, and suicide attempt. Compounded with this increased prevalence of trauma is the finding that transgender persons are less likely to seek and have access to medical care, which in some cases may delay presentation.<sup>77</sup> Concomitant mental health disorders are not uncommon, most frequently manifesting as depression, anxiety, and somatization.<sup>78</sup> Addressing these conditions with the appropriate involvement of mental health professionals, social workers, and case managers is requisite for successful rehabilitation following trauma.

When managing traumatic injuries in the hospital, it is important to consider dosing of medications based on the patient's ideal body mass, yet there are minimal data on this for transgender patients on cross-gender hormones. The same is true for nutrition when considering appropriate nutritional support.

Care must be taken to maintain privacy for the patient, as others outside of the hospital may not know they are transgender. Consultation with the patient's primary care provider may be beneficial to determine the extent of gender affirmation and the patient's disclosure to family and friends. Transgender patients may have strained or lost family relationships or friendships. A period of critical illness or death may require family involvement or re-establishing contact. Social work and spiritual care are instrumental to this process, which can be difficult for the patient and family members.

### Future Considerations

Very little information on the care of transgender patients in the setting of trauma is available. Further research is needed on the appropriate management of cross-gender hormones, dosing of medications and nutrition, and the special considerations for injury patterns and risks in transgender patients. Development of a system for quickly determining the state of gender affirmation of the patient with regard to hormone therapy, surgeries, and social aspects may prove beneficial to providers in the setting of trauma, but involvement of the transgender population in the development of any such system is crucial.

## CONCLUSIONS

It is likely that more trauma providers will encounter transgender patients as stigma and discrimination around this population abates and more people are undergoing transition. Very little information is known about the traumatic risks and modifications in management warranted for this population. Further research is needed, but this starts with awareness and education around the unique needs of this population. We all need to strive to provide the best care possible for our transgender patients and serve as a medical ally for the entire care team.

### AUTHORSHIP

S.D.M., S.M.K., J.P.M., and S.P.M. participated in the design of the study. S.D.M., S.M.K., J.P.M., and C.S.C. collected/analyzed/interpreted the data. S.D.M., S.M.K., J.P.M., C.S.C., and S.P.M. wrote the manuscript. S.D.M., S.M.K., J.P.M., C.S.C., D.D. III., J.B.F., T.N.P., J.U.B., G.E.O., E.M.B., R.V.M., and S.P.M. performed critical review of the paper. D.D. III and J.U.B. provided the photos.

### ACKNOWLEDGMENTS

The authors thank Saman Arbabi, MD, MPH, Joseph Cuschieri, MD, Heather Evans, MD, MS, Bryce Robinson, MD, and Erik Van Eaton, MD,

for their feedback on the development of this manuscript. Vania Rashidi assisted with development of some of the figures.

### DISCLOSURE

The authors declare no conflicts of interest.

### REFERENCES

1. American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders*. 5th ed. Washington, DC: American Psychiatric Association; 2013.
2. Selvaggi G, Dhejne C, Landen M, Elander A. The 2011 WPATH standards of care and penile reconstruction in female-to-male transsexual individuals. *Adv Urol*. 2012;2012:581712.
3. Chaiet SR, Morrison SD, Streed CG Jr. Gender Confirmation Surgery and Terminology in Transgender Health. *JAMA Surg*. 2017;152(11):1089–1090.
4. Winter S, Diamond M, Green J, Karasic D, Reed T, Whittle S, Wylie K. Transgender people: health at the margins of society. *Lancet*. 2016;388(10042):390–400.
5. Wylie K, Knudson G, Khan SI, Bonierbale M, Watanyusakul S, Baral S. Serving transgender people: clinical care considerations and service delivery models in transgender health. *Lancet*. 2016;388(10042):401–411.
6. Dickey LM, Singh AA, Walinsky D. Treatment of trauma and non-suicidal self-injury in transgender adults. *Psychiatr Clin North Am*. 2017;40(1):41–50.
7. Belkin A. Caring for our transgender troops—the negligible cost of transition-related care. *N Engl J Med*. 2015;373(12):1089–1092.
8. Benjamin H. *The Transsexual Phenomenon*. New York: Julian Press; 1966.
9. Berli JU, Knudson G, Fraser L, Tangpricha V, Ettner R, Ettner FM, Safer JD, Graham J, Monstrey S, Schechter L. What surgeons need to know about gender confirmation surgery when providing care for transgender individuals: a review. *JAMA Surg*. 2017;152(4):394–400.
10. Byne W, Bradley SJ, Coleman E, Eyler AE, Green R, Menvielle EJ, Meyer-Bahlburg HF, Pleak RR, Tompkins DA. American Psychiatric Association Task Force on Treatment of Gender Identity D. Report of the American Psychiatric Association Task Force on treatment of gender identity disorder. *Arch Sex Behav*. 2012;41(4):759–796.
11. Dhejne C, Lichtenstein P, Boman M, Johansson AL, Langstrom N, Landen M. Long-term follow-up of transsexual persons undergoing sex reassignment surgery: cohort study in Sweden. *PLoS One*. 2011;6(2):e16885.
12. Dhejne C, Oberg K, Arver S, Landen M. An analysis of all applications for sex reassignment surgery in Sweden, 1960–2010: prevalence, incidence, and regrets. *Arch Sex Behav*. 2014;43(8):1535–1545.
13. Gooren LJ. Clinical practice. Care of transsexual persons. *N Engl J Med*. 2011;364(13):1251–1257.
14. Morrison SD. The care transition in plastic surgery. *Plast Reconstr Surg*. 2015;136(6):861e–862e.
15. Morrison SD, Swanson JW. Surgical justice. *Plast Reconstr Surg*. 2015;136(2):291e–292e.
16. Dy GW, Osburn NC, Morrison SD, Grant DW, Merguerian PA. Transgender Education Study Group. Exposure to and attitudes regarding transgender education among urology residents. *J Sex Med*. 2016;13(10):1466–1472.
17. Morrison SD, Chong HJ, Dy GW, Grant DW, Wilson SC, Brower JP, Vedder NB, Berli JU, Friedrich JB. Transgender Educational Study Group. Educational exposure to transgender patient care in plastic surgery training. *Plast Reconstr Surg*. 2016;138(4):944–953.
18. Lee KP, Kelz RR, Dube B, Morris JB. Attitude and perceptions of the other underrepresented minority in surgery. *J Surg Educ*. 2014;71(6):e47–e52.
19. Moll J, Krieger P, Moreno-Walton L, Lee B, Slaven E, James T, Hill D, Podolsky S, Corbin T, Heron SL. The prevalence of lesbian, gay, bisexual, and transgender health education and training in emergency medicine residency programs: what do we know? *Acad Emerg Med*. 2014;21(5):608–611.
20. Obedin-Maliver J, Goldsmith ES, Stewart L, White W, Tran E, Brenman S, Wells M, Fetterman DM, Garcia G, Lunn MR. Lesbian, gay, bisexual, and transgender-related content in undergraduate medical education. *JAMA*. 2011;306(9):971–977.
21. Morrison SD, Dy GW, Chong HJ, Holt SK, Vedder NB, Sorensen MD, Joyner BD, Friedrich JB. Transgender-related education in plastic surgery and urology residency programs. *J Grad Med Educ*. 2017;9(2):178–183.

22. Morrison SD, Wilson SC, Smith JR. Are we adequately preparing our trainees to care for transgender patients? *J Grad Med Educ.* 2017;9(2):258.
23. Smith JR, Morrison SD, Gottlieb LJ. Are surgical residents prepared for fellowship training in gender-confirming surgery? *J Sex Med.* 2017;14(8):1066–1067.
24. Meerwijk EL, Sevelius JM. Transgender population size in the United States: a meta-regression of population-based probability samples. *Am J Public Health.* 2017;107(2):e1–e8.
25. Ainsworth TA, Spiegel JH. Quality of life of individuals with and without facial feminization surgery or gender reassignment surgery. *Qual Life Res.* 2010;19(7):1019–1024.
26. Capitan L, Simon D, Kaye K, Tenorio T. Facial feminization surgery: the forehead. Surgical techniques and analysis of results. *Plast Reconstr Surg.* 2014;134(4):609–619.
27. De Cuyper G, Elaut E, Heylens G. Long-term follow-up: psychosocial outcome of Belgian transsexuals after sex reassignment surgery. *Eur J Sex Health.* 2006;15:126–133.
28. The World Professional Association for Transgender Health. Standards of Care for the Health of Transsexual, Transgender, and Gender Nonconforming People. 7th Version, 2011.
29. Leiter E, Futterweit W, Brown GR. Gender reassignment: psychiatric, endocrinologic, and surgical management. In: Webster G, Kirby R, King L, eds. *Reconstructive Urology.* Boston, MA: Blackwell Scientific Publications; 1993.
30. Massie JP, Morrison SD, Smith JR, Wilson SC, Satterwhite T. Patient-reported outcomes in gender confirming surgery. *Plast Reconstr Surg.* 2017;140(1):236e–237e.
31. Monstrey S, Hoebeke P, Selvaggi G, Ceulemans P, Van Landuyt K, Blondeel P, Hamdi M, Roche N, Weyers S, De Cuyper G. Penile reconstruction: is the radial forearm flap really the standard technique? *Plast Reconstr Surg.* 2009;124(2):510–518.
32. Morrison SD, Perez MG, Nedelman M, Crane CN. Current state of female-to-male gender confirming surgery. *Curr Sex Health Rep.* 2015;7(1):38–48.
33. Morrison SD, Satterwhite T, Grant DW, Kirby J, Laub DR Sr, VanMaasdam J. Long-term outcomes of rectosigmoid neocolporrhaphy in male-to-female gender reassignment surgery. *Plast Reconstr Surg.* 2015;136(2):386–394.
34. Morrison SD, Shakir A, Vyas KS, Kirby J, Crane CN, Lee GK. Phalloplasty: a review of techniques and outcomes. *Plast Reconstr Surg.* 2016;138(3):594–615.
35. Morrison SD, Vyas KS, Motakef S, Gast KM, Chung MT, Rashidi V, Satterwhite T, Kuzon W, Cederna PS. Facial feminization: systematic review of the literature. *Plast Reconstr Surg.* 2016;137(6):1759–1770.
36. Nelson L, Whallett EJ, McGregor JC. Transgender patient satisfaction following reduction mammoplasty. *J Plast Reconstr Aesthet Surg.* 2009;62(3):331–334.
37. Selvaggi G, Bellringer J. Gender reassignment surgery: an overview. *Nat Rev Urol.* 2011;8(5):274–282.
38. Wierckx K, Van Caenegem E, Elaut E, Dedeker D, Van de Peer F, Toye K, Weyers S, Hoebeke P, Monstrey S, De Cuyper G, et al. Quality of life and sexual health after sex reassignment surgery in transsexual men. *J Sex Med.* 2011;8(12):3379–3388.
39. Berli JU, Capitán L, Simon D, Bluebond-Langner R, Plemons E, Morrison SD. Facial Gender Confirmation Surgery — Review of the Literature and Recommendations for Version 8 of the WPATH Standards of Care. *International Journal of Transgenderism.* 2017;8(3):264–270.
40. Morrison SD, Chen ML, Crane CN. An overview of female-to-male gender-confirming surgery. *Nat Rev Urol.* 2017;14(8):486–500.
41. Morrison SD, Crowe CS, Wilson SC. Consistent quality of life outcome measures are needed for facial feminization surgery. *J Craniofac Surg.* 2017;28(3):851–852.
42. Cho DY, Massie JP, Morrison SD. Ethnic considerations for rhinoplasty in facial feminization. *JAMA Facial Plast Surg.* 2017;19(3):243.
43. Bakker F, van der Sluis WB, Bouman MB, de Boer NK. Neovaginal diverticula: pathophysiology of colonic diverticulosis revisited. *Endoscopy.* 2015;47(Suppl 1):E611.
44. Foster D, Shaikh MF, Gleeson E, Babcock BD, Lin J, Ownbey RT, Hysell ME, Ringold D, Bowne WB. Pancreatic mucinous cystic neoplasm in a transgender patient. *World J Surg Oncol.* 2015;13:205.
45. Grasman ME, van der Sluis WB, de Boer NK. Neovaginal sparing in a transgender woman with ulcerative colitis. *Clin Gastroenterol Hepatol.* 2016;14(7):e73–e74.
46. Shields R, Lau B, Haider AH. Emergency general surgery needs for lesbian, gay, bisexual, and transgender patients: are we prepared? *JAMA Surg.* 2017;152(7):617–618.
47. Shimamura Y, Fujikawa A, Kubota K, Ishii N, Fujita Y, Ohta K. Perforation of the neovagina in a male-to-female transsexual: a case report. *J Med Case Rep.* 2015;9:24.
48. Hembree WC, Cohen-Kettenis P, Delemarre-van de Waal HA, Gooren LJ, Meyer WJ 3rd, Spack NP, Tangpricha V, Montori VM. Endocrine Society. Endocrine treatment of transsexual persons: an Endocrine Society clinical practice guideline. *J Clin Endocrinol Metab.* 2009;94(9):3132–3154.
49. Song TE, Jiang N. Transgender phonosurgery: a systematic review and meta-analysis. *Otolaryngol Head Neck Surg.* 2017;156(5):803–808.
50. Meister J, Hagen R, Shehata-Dieler W, Kühn H, Kraus F, Kleinsasser N. Pitch elevation in male-to-female transgender persons—the Würzburg approach. *J Voice.* 2017;31(2):244.e7–244.e15.
51. Morrison SD, Crowe CS, Rashidi V, Massie JP, Chalet SR, Francis DO. Beyond phonosurgery: considerations for patient-reported outcomes and speech therapy in transgender vocal feminization. *Otolaryngol Head Neck Surg.* 2017;157(2):349.
52. Deschamps-Braly JC, Sacher CL, Fick J, Ousterhout DK. First female-to-male facial confirmation surgery with description of a new procedure for masculinization of the thyroid cartilage (Adam's apple). *Plast Reconstr Surg.* 2017;139(4):883e–887e.
53. Ousterhout DK. Dr. Paul Tessier and facial skeletal masculinization. *Ann Plast Surg.* 2011;67(6):S10–S15.
54. Weigert R, Frison E, Sessiecq Q, Al Mutairi K, Casoli V. Patient satisfaction with breasts and psychosocial, sexual, and physical well-being after breast augmentation in male-to-female transsexuals. *Plast Reconstr Surg.* 2013;132(6):1421–1429.
55. Murariu D, Holland MC, Gampper TJ, Campbell CA. Illegal silicone injections create unique reconstructive challenges in transgender patients. *Plast Reconstr Surg.* 2015;135(5):932e–933e.
56. Frederick MJ, Berhanu AE, Bartlett R. Chest surgery in female to male transgender individuals. *Ann Plast Surg.* 2017;78(3):249–253.
57. Monstrey S, Selvaggi G, Ceulemans P, Van Landuyt K, Bowman C, Blondeel P, Hamdi M, De Cuyper G. Chest-wall contouring surgery in female-to-male transsexuals: a new algorithm. *Plast Reconstr Surg.* 2008;121(3):849–859.
58. Buncamper ME, van der Sluis WB, van der Pas RS, Ozer M, Smit JM, Witte BI, Bouman MB, Mullender MG. Surgical outcome after penile inversion vaginoplasty: a retrospective study of 475 transgender women. *Plast Reconstr Surg.* 2016;138(5):999–1007.
59. Bouman MB, van der Sluis WB, Buncamper ME, Ozer M, Mullender MG, Meijerink WJ. Primary total laparoscopic sigmoid vaginoplasty in transgender women with penoscrotal hypoplasia: a prospective cohort study of surgical outcomes and follow-up of 42 patients. *Plast Reconstr Surg.* 2016;138(4):614e–623e.
60. Bouman MB, van der Sluis WB, van Woudenberg Hamstra LE, Buncamper ME, Kreukels BP, Meijerink WJ, Mullender MG. Patient-reported esthetic and functional outcomes of primary total laparoscopic intestinal vaginoplasty in transgender women with penoscrotal hypoplasia. *J Sex Med.* 2016;13(9):1438–1444.
61. Weyers S, Selvaggi G, Monstrey S. Two-stage versus one-stage sex reassignment surgery in female-to-male transsexual individuals. *Gynaecol Surg.* 2006;3:190–194.
62. Djordjevic ML, Bizic MR. Comparison of two different methods for urethral lengthening in female to male (metoidioplasty) surgery. *J Sex Med.* 2013;10(5):1431–1438.
63. Hage JJ. Metoidioplasty: an alternative phalloplasty technique in transsexuals. *Plast Reconstr Surg.* 1996;97(1):161–167.
64. Morrison SD, Son J, Song J, Berger A, Kirby J, Ahdoot M, Lee GK. Modification of the tube-in-tube pedicled anterolateral thigh flap for total phalloplasty: the mushroom flap. *Ann Plast Surg.* 2014;72(Suppl 1):S22–S26.

65. Massie JP, Morrison SD, Wilson SC, Crane CN, Chen ML. Phalloplasty with Urethral Lengthening: Addition of a Vascularized Bulbospongiosus Flap from Vaginectomy Reduces Postoperative Urethral Complications. *Plast Reconstr Surg*. 2017;140(4):551e–558e.
66. Selvaggi G, Hoebeke P, Ceulemans P, Hamdi M, Van Landuyt K, Blondeel P, De Cuyper G, Monstrey S. Scrotal reconstruction in female-to-male transsexuals: a novel scrotoplasty. *Plast Reconstr Surg*. 2009;123(6):1710–1718. Epub 2009/06/02. eng.
67. Hoebeke PB, Decaestecker K, Beysens M, Opendakker Y, Lumen N, Monstrey SM. Erectile implants in female-to-male transsexuals: our experience in 129 patients. *Eur Urol*. 2010;57(2):334–340.
68. Neuville P, Morel-Journel N, Maucourt-Boulch D, Ruffion A, Paparel P, Terrier JE. Surgical outcomes of erectile implants after phalloplasty: retrospective analysis of 95 procedures. *J Sex Med*. 2016;13(11):1758–1764.
69. Landers S, Gilsanz P. *The Health of Lesbian, Gay, Bisexual, and Transgender (LGBT) Persons in Massachusetts*. Boston, MA: Massachusetts Department of Public Health; 2009.
70. Kenagy GP. Transgender health: findings from two needs assessment studies in Philadelphia. *Health Soc Work*. 2005;30(1):19–26.
71. Lombardi EL, Wilchins RA, Priesing D, Malouf D. Gender violence: transgender experiences with violence and discrimination. *J Homosex*. 2001;42(1):89–101.
72. Rabin RF, Jennings JM, Campbell JC, Bair-Merritt MH. Intimate partner violence screening tools: a systematic review. *Am J Prev Med*. 2009;36(5):439.e4–445.e4.
73. Ueda S, Fortune V, Bull BS, Valenzuela GJ, Longo LD. Estrogen effects on plasma volume, arterial blood pressure, interstitial space, plasma proteins, and blood viscosity in sheep. *Am J Obstet Gynecol*. 1986;155(1):195–201.
74. Bates SM, Jaeschke R, Stevens SM, Goodacre S, Wells PS, Stevenson MD, Kearon C, Schunemann HJ, Crowther M, Pauker SG, et al. Diagnosis of DVT: antithrombotic therapy and prevention of thrombosis, 9th ed: American College of Chest Physicians evidence-based clinical practice guidelines. *Chest*. 2012;141(Suppl 2):e351S–e418S.
75. Clements-Nolle K, Marx R, Katz M. Attempted suicide among transgender persons: the influence of gender-based discrimination and victimization. *J Homosex*. 2006;51(3):53–69.
76. Mizock L, Lewis TK. Trauma in transgender populations: risk, resilience, and clinical care. *Journal of Emotional Abuse*. 2008;8(3):335–354.
77. Grant JM, Morttet LA, Tanis J, Herman JL, Harrison J, Keisling M. *Injustice at Every Turn: A Report of the National Transgender Discrimination Survey*. New York, NY: National Center for Transgender Equality and the National Gay and Lesbian Task Force; 2010.
78. Bockting WO, Miner MH, Swinburne Romine RE, Hamilton A, Coleman E. Stigma, mental health, and resilience in an online sample of the US transgender population. *Am J Public Health*. 2013;103(5):943–951.