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The Perioperative Care of the Transgender Patient

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Abstract

An estimated 25 million people identify as transgender worldwide, approximately 1 million of whom reside in the United States. The increasing visibility and acceptance of transgender people makes it likely that they will present in general surgical settings; therefore, perioperative health care providers must develop the knowledge and skills requisite for the safe management of

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transgender patients in the perioperative setting. Extant guidelines, such as those published by the World Professional Association for Transgender Health and the University of California San Francisco Center of Excellence for Transgender Health, serve as critical resources to those caring for transgender patients; however, they do not address their unique perioperative needs. It is essential that anesthesia providers develop the knowledge and skills necessary for safely managing transgender patients in the perioperative setting. This review provides an overview of relevant terminology, the imperative for the provision of culturally sensitive care, and guidelines for preoperative, intraoperative, and postoperative management of the transgender patient.

The term “transgender” is used to describe people who identify as gender discordant from the sex they were assigned at birth. An estimated 25 million people identify as transgender worldwide, approximately 1 million of whom reside in the United States.¹⁻³ The increasing visibility and acceptance of transgender people makes it likely that they will present more frequently in general surgical settings.

TRANSGENDER TERMINOLOGY

Critical to the understanding of what it means to be transgender is recognition that although they are often used interchangeably, gender and sex are distinct. Sex refers to those physical characteristics (eg, hormones, chromosomes, reproductive organs) used to assign people as male, female, or intersex. In contrast, gender is a social construct, rooted in cultural expectations that drive an individual’s outward appearance and behavior. While some cultures celebrate the existence of >2 genders (eg, Indigenous North American “two-spirit” and Samoan “fa’afafine”),^{4,5} the conceptualization of gender as binary (a person is either a man or woman) has dominated Western societies. However, this discourse is shifting to an approach that appreciates gender as a continuum,⁶ along which a person’s gender may fall anywhere, everywhere, or nowhere.⁷ Although some transgender people identify within the dichotomous model of man or woman, the continuum approach frees people to be authentic, both internally (gender identity) and externally (gender expression). This has given rise to an evolving array of terms to describe one’s gender or genders^{8,9} (Table 1) and the freedom to express characteristics such as their movement, dress, and mannerisms in ways commonly referred to as masculine, feminine, neither, or both.

GENDER-CONFIRMING THERAPIES (HORMONE THERAPY VERSUS GENDER-CONFIRMING SURGERY)

Transgender individuals may undergo processes to affirm a gender identity different from that assigned at birth, known as “transition.” The extent of this transition is highly variable; some people do not transition at all, some change socially, such as their mannerisms and/or dress, some use techniques such as binding (methods to flatten breast tissue to create a male-appearing chest) or tucking (pushing the testes into the inguinal canal and securing the penis back between the legs with gaff, an undergarment that flattens any bulging), and still others opt for medical and/or surgical interventions.^{6,10} The simplified overview presented here is derived from comprehensive standards and guidelines used to support those who wish to transition.^{6,11,12}

Hormone therapy (HT) is generally the first medical intervention for those who wish to align their physical characteristics with their identified gender. For transgender women, exogenous estrogen is used in conjunction with antiandrogens with the goal of developing female secondary sex characteristics (eg, breast development, redistribution of fat, reduction in body hair) and minimizing male characteristics (eg, softening of skin, slowing of scalp alopecia).¹¹ For transgender men, exogenous testosterone is used to develop male secondary sex characteristics (eg, deepening vocal register, development of facial hair, increased muscle mass).^{11,12} Changes to insurance coverage have increased accessibility to HT for some transgender people; for many, insurance remains a barrier. Transgender people may have difficulty finding medical providers who are knowledgeable about their specific health needs, including provision of hormonal therapy. Factors such as lack of access to prescription hormones and the desire to transition more quickly lead some transgender people to alternate sources for hormones, such as the Internet and illicit dealers.^{13,14} In addition, some transgender women may inject silicone into their breasts, buttocks, thighs, and face to feminize their appearance. The use of silicone injections is associated with adverse outcomes such as infections, silicone migration, granulomatous disease, pneumonitis, and organ failure.^{15–18}

Gender-confirming surgeries are also used to transition; barriers such as lack of insurance and the small number of surgeons with specialty training may render this approach an unobtainable option for many. A variety of surgical approaches is available and should be tailored to the patient.⁶ Surgical interventions for transgender women may involve breast augmentation, orchiectomy, vaginoplasty, laryngeal surgery, and/or facial feminization, among others.¹⁹ Transgender men may undergo top surgery (mastectomy and additional reconstructive techniques) and bottom surgery, wherein the female organs are removed and genital reconstruction is achieved through metoidioplasty or phalloplasty, and/or facial masculinization surgery; it is important to remember that many transgender men choose to retain their uterus and ovaries though they undergo transition-related surgeries.¹⁹

The American Society of Plastic Surgery's annual report showed that in 2016, 1759 transfeminine patients and 1497 transmasculine patients underwent gender confirmation procedures, an increase of 27% and 10%, respectively, compared to 2015.²⁰ However, getting a true estimate of the number of gender confirmation surgeries is not straightforward because many surgeries may be conducted by other surgical subspecialties (eg, urologists, obstetrician/gynecologists, maxillofacial surgeons). A recent survey of almost 28,000 transgender individuals revealed that among people assigned female at birth, 21% had chest reconstruction, 8% hysterectomy, 1% metoidioplasty, and 1% phalloplasty. Among people assigned male at birth, 10% had undergone vaginoplasty or labiaplasty, 9% orchiectomy, 8% augmentation mammoplasty, and 6% facial surgery.¹³

HEALTH AND WELLNESS

Failure to systematically collect accurate gender data, specifically gender and sex assigned at birth, impairs our understanding of the health of transgender people. Despite calls for collection of these data,^{21–23} implementation has been slow in clinical settings and largely absent in large-scale population surveys. This is largely related to limited funding

opportunities for research and policy initiatives. The resultant implications are extensive and translate to inadequacy of evidence on the clinical care of transgender populations. In attempt to move the care of transgender people forward, leaders in the field rely on the most comprehensive available data. Most recently, the largest study of the experiences of transgender people in the United States revealed staggering disparities related to social determinants of health such as violence, housing instability, access to medical care, and lack of familial and other social support.^{13,14}

Although being transgender does not determine a person's health, the experiences of transphobia, enacted and felt stigma, and microaggressions are associated with various adverse health outcomes, such as higher rates of mood disorders, substance use, and elevated risk for human immunodeficiency virus (HIV) and sexually transmitted infections.²⁴⁻²⁷ The transgender population has long been stigmatized with the diagnosis of "gender identity disorder" until publication of the Diagnostic and Statistical Manual of Mental Disorders, 5th Edition,²⁸ which changed the diagnosis to "gender dysphoria." This was a critical step, providing a way to call attention to the distress associated with the incongruence between one's gender identity and sex assigned at birth, rather than classifying it as an illness.²⁸ While the use of a psychiatric diagnosis is controversial, some suggest that it adds value by supporting access to care for transgender people who may benefit from treatment.²⁹

Barriers to health care are multifactorial. Transgender people experience severe economic instability, including 3 times the US unemployment rate and twice the likelihood of living in poverty.^{13,14} Encounters in health care settings are marked with insensitivity and other negative experiences including refusal of treatment, harassment, and assault.^{13,14,30} Widespread discrimination and mistreatment threaten the health and wellness of transgender people making them one of the most marginalized populations in medicine.³¹ Fortunately, the National Institutes of Health's recent designation of transgender people (under the umbrella of sexual and gender minority populations) as a National Disparity Population is now providing the impetus for research on the health of transgender people.

PREOPERATIVE CARE

With increased access to health care offered by the Patient Protection and Affordable Care Act, transgender patients may present more frequently to preoperative clinics for routine surgery. The American Society of Anesthesiologists refers to the preanesthesia evaluation as "the process of clinical assessment that precedes the delivery of anesthesia care for surgery and for nonsurgical procedures," which entails procurement of information from several sources.³² Goals of this evaluation include optimization of the patient through risk reduction and informed consent.³³ Generally, the provider involved in the preanesthetic evaluation has the knowledge and access to resources to prepare individuals for surgery and anesthesia.

The paucity of evidence-based literature, lack of health care education, and absence of a holistic approach to the health care of transgender patients may translate into health care providers who are unfamiliar and unprepared to manage this unique population.

Self Identification

Ideally, gender identity data (sex assigned at birth, gender identity, preferred name, and preferred pronouns) are collected on intake forms.³⁴ The best practice for collection of gender identity, which is to use a 2-step question using gender identity followed by sex assigned at birth,³⁵ has been found to be both feasible and acceptable to patients (Table 2).³⁶ Capturing preferred name (versus legal name) and pronoun (Table 3) provides the necessary data for staff to address patients throughout hospitalization. Even when collected appropriately, however, the use of these data is limited by the extent to which they are displayed in the electronic health record. As health care systems develop their electronic health records to support the meaningful display of gender identity data, many are currently forced to develop makeshift strategies, such as including information as free text in existing open fields.

Regardless of the extent to which the electronic medical record provides access to patients' gender identity data, a transgender patient may present to the preanesthetic clinic with legal documents incongruent with their preferred name and/or gender identity. Carefully noting patients' legal photograph identification (eg, driver's license, passport) and insurance card are particularly important. The intricacies involved in ensuring proper documentation for legal and insurance purposes often necessitates conferring with hospital resources, such as legal, patient advocate, and financial departments.

Hormone Therapy

It is important that anesthesia providers are knowledgeable about the hormonal therapies used for medical transition because these treatments may affect perioperative care (Table 4). Leading sources for education regarding transgender HT and clinical practice can be guided by current evidence and expert opinion, using *The Standards of Care for the Health of Transsexual, Transgender and Gender-Nonconforming People*, issued by the World Professional Association for Transgender Health³⁸ and integrated in the Endocrine Treatment of Transsexual Persons guidelines of The Endocrine Society.^{12,39} While helpful, these guidelines on the use and interpretation of laboratory data when transgender people are receiving hormonal therapy are predominantly based on expert opinion and anecdotal experiences.¹⁰ Other concerns include varying dosing regimens, sex-based laboratory reference values, and the safety of short-/long-term use of HT.

Feminizing HT consists of regimens of testosterone blockade combined with estrogens.^{39,40} Estrogens are available in different formulations, including oral, transdermal patches, and parenteral. Commonly used androgen blockers include spironolactone, 5 α -reductase inhibitors, such as finasteride, and gonadotropin-releasing hormone agonists such as leuprolide and goserelin (Table 4). HT is continued lifelong unless adverse effects preclude their use. Documented adverse effects of estrogens include a possible increased risk of venous thromboembolism (VTE), changes in lipid profile, vomiting, or migraine headache.^{38,41} Risk of VTE with estrogens is related to the formulation prescribed. Orally administered estrogens are more likely to increase the risk due to an altered balance between anticoagulant and procoagulant endogenous factors. In a Dutch study, the incidence of thrombosis was 20 times greater in the first 2 years of estrogen therapy.⁴² Risk rises in

patients who smoke and those on oral estrogen preparations (conjugated estrogens and ethinylestradiol). Some surgeons advocate discontinuance of hormones 2–4 weeks before surgery.¹⁹ Anesthesia providers should be aware that patients who are advised to stop their hormones before surgery may experience emotional and physical effects. Common symptoms include mood swings and hot flashes.⁴³ If patients stop their hormones for longer periods, this can result in reversal of the feminizing effects.

Masculinizing HT follows the principle of hormone replacement treatment of male hypogonadism by supplementing testosterone to achieve testosterone laboratory values in the normal male range.^{39,40} Testosterone is available in different formulations (eg, transdermal gels, patches, parenteral) (Table 4). Testosterone supplementation may have undesirable effects that can be detrimental during the perioperative period; accordingly, testing should focus on identifying these abnormalities in the preoperative period. Despite the assumption that there is an increased perioperative cardiovascular risk in transgender men taking testosterone, to date, there is no conclusive evidence to support this. While there is triglyceride elevation (albeit no alteration in total cholesterol), myocardial infarction rates among transgender men are only one third that of their cisgender male counterparts.⁴² Adverse effects such as erythrocytosis, liver dysfunction, lipid level changes, acne, and adverse psychological changes can also occur.⁴⁴ If patients stop their hormones for longer periods, this can result in reversal of the masculinizing effects, including loss of muscle mass and resumption of menses.

Due to the fact that complete withdrawal of hormone treatments can have a profound impact on the patient, the surgeon and endocrinologist should collaborate in making a decision on the use of hormones during the month before surgery and reinitiation of HT after surgery.^{38,39}

Laboratory Testing

Laboratory testing is an important process in the preparation of the preprocedural patient. However, it is important to note specific issues that are related to the transgender patient population. Particular attention needs to be taken when interpreting values for transgender patients especially those on hormonal therapies. This is often complicated by the various treatment regimes available for transition and the degree of transition completion. Awareness of appropriate reference values is important in identifying values outside normal range, and many laboratory values are calculated utilizing the patient's biologic sex for pharmacological computations. Additionally, laboratory tests should be ordered based on biological sex (eg, prostate specific antigen [PSA] for transgender female, human chorionic gonadotropin [hCG] for transgender male).^{39,45} For transgender patients who receive hormones and/or testosterone blockers, alterations in laboratory values may be present that are related to the pharmacology of the replacement therapies. Hormone replacement therapies can influence many hematologic, general chemistry, and special chemistry/endocrine values (Table 5).⁴⁵ These changes to laboratory results are highly variable in terms of an increase, decrease, or no change as cited by Goldstein et al.⁴⁵ When interpreting values for transgender patients receiving hormones, it is important to consider the physiology behind each test and whether the male or female range is more appropriate. It

has been suggested that transitioning transgender patients on hormone replacement therapy for >6 months should have their laboratory values compared to that of their cis-counterparts and not their sex assigned at birth⁴⁵ However, limited evidence is available to guide the evaluation of laboratory test interpretation in the different stages of transition.

Transgender women have also been shown to experience higher rates of HIV infection,⁴⁰ and preoperative laboratory testing and preparation should be conducted accordingly.

Pregnancy Testing

Transgender men may have intact female reproductive organs, internally and/or externally, and clinicians must always consider the possibility of pregnancy in these patients. The American Society of Anesthesiologists recommends screening for pregnancy in all [biologic] women of childbearing age in whom the result would change the course of medical management. On cessation of testosterone, the possibility of becoming pregnant greatly increases if sexual activity involves a biologic, sperm-producing sexual partner. Because of this, it is imperative that all transgender patients with potential for pregnancy have pregnancy testing as part of their preoperative workup.

Privacy

Transgender patients may incite undue curiosity and attention of perioperative staff due to lack of experience with this patient population. A chaperone should be present during physical examinations, and the gender of the chaperone should be decided on by the patient. To minimize invasion of privacy and maintain dignity for transgender patients, it is important to conduct physical examinations when medically indicated; clinicians must avoid delivering suboptimal care stemming from unfounded concerns surrounding privacy issues and fear of offending these patients.

INTRAOPERATIVE CARE

Caring for transgender patients during the intraoperative period requires unique, population-specific considerations involving anatomical, physiological, psychological, and pharmacological aspects. The anesthetic should be planned with careful consideration to all unique findings during the preoperative workup. Perioperative staff should be informed of the patient's preferred pronouns, and these should be maintained throughout the perioperative period.⁴⁶ As mentioned previously, privacy is important and efforts should be made to minimize traffic and rotation of staff in the operating room, especially if the surgical procedure involves exposure of the genitalia or chest area.

Venous Thromboembolism

Major perioperative concerns facing transgender patients include VTE such as deep vein thrombosis and pulmonary embolism. These hematological events are related to immobility during surgery for all patients, but the thrombotic effects of transgender HT put this patient population at higher risk. Transgender women are often taking estrogen therapy for testosterone suppression. Rates of VTE in the literature for transgender women on estrogen therapy range from 0% to 6%.^{47,48} Protocols on the use of estrogen in transgender women

should consider additional VTE risk factors such as smoking, hypercoagulable disorders, cancer diagnosis, length of surgery, and duration of immobilization.⁴⁷ Because of this, intraoperative VTE prophylaxis in the form of subcutaneous heparin and sequential compression devices are essential.⁴⁹

Drug Interactions

There are no documented drug–drug interactions among estrogen, the various androgen blockers, and testosterone with anesthesia medications. Administration of anesthetic to transgender patients during the intraoperative period should proceed according to standard practice.

Anatomical Considerations

If a transgender patient has undergone gender-confirming surgery involving the urethra, such as vaginoplasty, phalloplasty, or metoidioplasty with urethral lengthening, placement of a urinary catheter may necessitate using a smaller catheter. In some circumstances, a urologist or other practitioner experienced with transgender anatomy may need to be consulted.

Transgender women may have completed a laryngoplasty and/or chondroplasty to alter the voice pitch. Risks of these procedures include vocal cord damage, reduction of tracheal lumen or stenosis, dysphagia,⁵⁰ or tracheal perforation. These are important details that directly affect intraoperative airway management and necessitate caution during intubation.
51

In transgender men who have not undergone genderconfirming surgery, breast binders or chest wraps are commonly used. While literature is lacking, these can potentially pose risks to respiratory function due to their restrictive purpose. Providers must clearly explain to patients that these devices should not be present during the intraoperative and immediate postoperative period. An agreement should be established regarding appropriate time for removal as well as plan for reapplication that satisfies the patient.

Other Considerations

Transgender women experience higher rates of HIV infection.⁴⁰ Anesthesia providers need to be vigilant of increased intraoperative risks due to cardiovascular, respiratory, renal, and hepatic compromise. Additionally, antiviral medications are primarily metabolized by the cytochrome P450 enzymes. Sedatives, hypnotics, anxiolytics, and antibiotics may have significant interactions with antiretrovirals; hence, clinicians must assess for potential drug–drug interactions and altered metabolism.⁵²

The cardiovascular risks associated with testosterone therapy in cisgender men are not well understood with data showing both increased and decreased risk as compared to a sex hormone–deprived state.⁵³ However, parenteral testosterone formulations are also associated with a greater incidence of erythropoietin production and hematocrits >48% are linked to higher rates of stroke due to greater blood viscosity.^{42,54} Preexisting coronary artery disease and testosterone therapy warrant careful consideration during anesthesia induction, maintenance, and intraoperative monitoring to prevent cardiovascular complications.

POSTOPERATIVE CARE

The postoperative period also poses a challenging time for transgender patients as they deal with issues of postoperative pain, withdrawal, anxiety, and depression. These are additive to existing concerns over discriminatory health care treatment. Patients should never feel disrespected in the health care setting; unintentional actions that lead to patient distress should be confronted directly and resolution should include a forthright admission that highlights the oversight or offensive event. Awkward or negative interactions with health care providers cause not only psychological discomfort in transgender patients but can also result in experiencing substandard or forced care and loss of the necessary trusting relationship between provider and patient. As previously emphasized, sensitivity training of staff is essential in fostering feelings of respect and trust between the transgender patient and health care provider.

Detailed report and handoff between care providers at different stages are important in the postoperative period when the patient may be unable to accurately confirm medical history and name/pronoun due to residual anesthetic effects.

Postanesthesia Care Unit

The postanesthesia care unit tends to be a busy, high traffic area, accessed by many health care providers, resulting in limited patient privacy. Health care providers should avoid having discussions that can be overheard by neighboring patients and staff who are not involved in the care of the transgender patient. While this is a principle that is applied to all patients, it is of utmost importance to the transgender population because of concerns over discriminatory health care treatment. When a transgender patient has visitors, health care providers must be cognizant of discussion with family and friends that could result in undesired “outing” of the patient.

Room Assignments

Transgender patients should be roomed in accordance with their gender identity. If the medical record is unable to accommodate sex and gender as distinct values, careful communication is necessary to ensure that staff involved in the care of the patient, including support staff, are aware of the intentional discrepancy. If a private room is available, it should be offered as an option because the increased privacy may provide additional comfort and/or safety for the patient. However, offering a private room as the only option should be avoided because it may cause patients to feel isolated instead.⁵⁵ It is important to note that including the patient in discussions around room assignment as early as possible will help circumvent issues before they arise.

Psychosocial Issues

Transgender people have been shown to have higher rates of anxiety and depression than the general population.⁵⁶ Mental health problems are often exacerbated by surgery and prolonged inpatient hospital stays.⁵⁷ When possible, use both pharmacological and nonpharmacological interventions to support the patient’s mental health in the postoperative period. A team approach involving mental health, social work, and spiritual care to address

all aspects of the patient's discomfort often yields the best results. Community and social work support should also be implemented early in the postoperative period to ease the process of discharge and assist with the transition to recovery at home.

While pain management, as well as physical therapy/rehabilitation and mental health follow-ups are crucial in the subacute phase for the general population, it is of even greater importance for the transgender patients. They will require closer and more attuned follow-up visits with each of these services to address the complex and intertwined needs with a multiprong approach.

Transgender patients may have avoided health care due to fear of stigma and discrimination, leading to health conditions that are not well controlled. Transgender patients living with HIV, for example, are less likely to receive antiretrovirals and to achieve viral suppression.^{58,59} This, along with other health conditions, such as higher rates of tobacco and illicit substance use may negatively impact recovery from surgery. To optimize postoperative care of these patients, the appropriate subspecialty services should be consulted early in the process with the goal of immediate and close follow-up in the postoperative period so as to facilitate the patient's recovery.

DISCUSSION

Facilitating easy access and coordination of various subspecialty services, such as endocrinology, anesthesiology, psychotherapy, psychiatry, and social work, ultimately promotes the perioperative care and recovery of the trans-gender patient. However, to achieve this consequential imperative, providers need to be properly educated and vetted in the care of the transgender patient.

Appropriate training for clinicians caring for this population requires both health information education and sensitivity training especially in light of the stigmas and misconceptions associated with the transgender community. Such training needs to begin early in the education of health care providers. For instance, many medical students have inadequate training in lesbian, gay, bisexual, transgender (LGBT) health and particularly in transgender medicine.⁶⁰ Residency training provides a time and opportunity for these gaps to be addressed. Program directors should ensure that topics in transgender health care are included in the residency training curriculum, addressing cultural competency and standards of care for HT and gender confirmation surgeries.

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Table 1

Terminology

Term	Definition
Cisgender	People whose gender identity matches their sex assigned at birth
Transgender male (female to male)	A person who was assigned female at birth but identifies as a man or on the masculine spectrum
Transgender female (male to female)	A person who was assigned male at birth but identifies as a woman or on the feminine spectrum
Nonbinary, gender nonconforming, genderqueer	Genders that fall outside the binary conceptualization of gender. A person may identify as both male and female, or as neither or a combination of male and female genders.

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Table 2

Collection of Gender Identity on a Patient Intake Form

1. What is your current gender identity? (check and/or circle all that apply)

- Male
- Female
- Transgender male/transman/FTM
- Transgender female/transwoman/MTF
- Genderqueer
- Additional category (please specify): _____
- Decline to answer

2. What sex were you assigned at birth? (check one)

- Male
 - Female
 - Decline to answer
-

Adapted from the University of California San Francisco, Center of Excellence for Transgender Health.

Abbreviations: FTM, female to male; MTF, male to female.

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Table 3

Gender Pronouns

Identification	Pronoun
Cis-male	He/him/himself
Cis-female	She/her/herself
Transgender male: female → male	He/him/himself
Transgender female: male → female	She/her/herself
Nonbinary: gender nonconforming	They/them/themself
Gender neutral	Zhe/zhim/zher/zhers/zhimself

Adapted from the Table “Proposed Mapping of Gender ID, Gender Markers, and Pronouns” from the article by Deutsch and Buchholz.³⁷

Table 4**Hormone Therapies for Gender Dysphoria**

Male to Female	Female to Male
Androgen suppression	Testosterone
Cyproterone acetate (not available in United States)	Testosterone gel
Medroxyprogesterone acetate (IM)	Testosterone patch
Spirolactone (oral)	Testosterone undecanoate (IM only in United States)
Finasteride (oral)	Testosterone enanthate, cypionate (SQ, IM)
Histrelin (SQ implant)	Testopel (SQ implant)
Progesterone (oral)	
Estrogen	
Estradiol (oral, IM, SQ, transdermal)	

Abbreviations: IM, intramuscular; SQ, subcutaneous.

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Table 5

Published Observational Changes in Laboratory Values for Transgender People on Hormone Therapy Irrespective of Phenotypic Response

	Transwomen	Transmen
Increased	HDL ^a	Hematocrit
	LDL ^a	Hemoglobin
	Total cholesterol ^a	Red cell count
	Triglycerides ^a	ALT
		AST
		Creatinine
		Total cholesterol ^a
		Triglycerides ^a
		HDL ^a
Decreased	Hematocrit	HDL ^a
	Hemoglobin	
	ALT	
	AST	
	Creatinine	
	HDL ^a	
	LDL ^a	
	Total cholesterol ^a	
Triglycerides ^a		
No change	Total cholesterol ^a	LDL
	Triglycerides ^a	HDL ^a
		Total cholesterol ^a
		Triglycerides ^a

Adapted from Goldstein et al.⁴⁶

Abbreviations: ALT, alanine aminotransferase; AST, aspartate amino-transferase; HDL, high-density lipoprotein; LDL, low-density lipoprotein.

^aThe literature shows contradictory data.