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The Role of the Athletic Trainer in Providing Care to Transgender and Gender-Diverse Patients: Considerations for Medical Affirmation—Part II

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Recently, with discriminatory legislation efforts and changing participation policies in organized sports, media attention surrounding transgender and gender-diverse (TGD) individuals has increased. These changes and the historical lack of competence and education regarding the transgender patient population have resulted in subpar patient care and a misunderstanding of the athletic trainer's (AT's) role within the health care and compliance systems. This literature review is the second part of a 2-paper series, and our objective was to educate ATs on the processes relevant to medical affirmation, including compliance considerations regarding medical eligibility, and to establish the AT's role.

The gender affirmation framework includes social and legal components, which are discussed in part 1 of this literature, and the medical component is thoroughly discussed in part 2. All health care providers involved in the care of TGD individuals should work collaboratively on an interprofessional care team and have a general knowledge of the gender-affirmation process, including gender-affirming hormone therapy, surgical options, known risks and complications, and the general health needs of TGD patients. With this knowledge, ATs, as point-of-care providers and members of the interprofessional care team, are uniquely positioned to help reduce health and health care disparities. Furthermore, ATs can use their knowledge to facilitate medical compliance and eligibility in the evolving policies of sporting organizations.

Key Words: hormone therapy, identity, compliance, inclusion, diversity, LGBTQIA+

Key Points

- Athletic trainers need to be knowledgeable about the gender affirmation framework, specifically the different interventions associated with gender-affirming care and their effects on sports participation and policy adherence.
- Knowledge of the gender affirmation framework allows an athletic trainer to navigate the complexities of medical eligibility while serving as a patient advocate and member of the interprofessional care team.

An increasing number of Americans, most notably young Americans, openly identify as transgender or gender diverse (TGD).[1–3] Athletic trainers (ATs) are in a unique and favorable position to help as the point-of-care medical providers for athletes. As mentioned in part 1 of this literature review, ATs play an important role on the interprofessional care team, creating inclusive health care facilities and reducing the health and health care disparities disproportionately experienced by TGD patients. Additionally, ATs can play a vital role in assisting TGD athletes navigating the complexities of medical eligibility from a compliance standpoint. Currently, research has indicated that ATs lack formal education and competence regarding the effects of hormone therapy on sport participation.[4] Not only have ATs recognized their own deficits, but TGD athletes have also identified a lack of education among their ATs.[5] Therefore, it is imperative for ATs to be knowledgeable about the gender affirmation framework, specifically the different interventions associated with gender-affirming care and their effect on sports participation and policy adherence.

Many TGD individuals choose to undergo social, legal, or medical gender affirmation to better align their sex assigned at birth and gender identity. Part 1 of the narrative literature review discusses the social and legal components of the gender-affirmation framework, whereas the focus of part 2 of this review is medical affirmation. As discussed in part 1 of this literature review, ATs did not feel competent or had not received adequate education in several areas involving TGD patient care.[6,7] Thus, the purpose of the second portion of this 2-part narrative literature review was to (1) discuss processes relevant to medical affirmation, including gender-affirming hormone therapy (GAHT) and surgical procedures, (2) explore compliance considerations for TGD individuals participating in organized sport, and (3) identify the role of

the AT within an interprofessional care team treating TGD patients. The literature presented in this review is a compilation of criterion standard guidelines of care for this patient population. In addition, pharmaceutical databases were used for specific drug information.

Gender-Affirming Hormone Therapy

As a part of the medical affirmation process to more closely align their bodies with their gender identities, TGD individuals may seek GAHT.[8] One major component of GAHT is exogenous hormones,[9] which are considered medically necessary for many TGD individuals.[9] In general, hormone therapy is divided into masculinizing testosterone-based therapy and feminizing estrogen-based therapy.[10] Testosterone is used to develop secondary male sex characteristics, known as virilization, and to suppress feminizing characteristics.[9] Exogenous estrogen is typically used to assist in feminization, whereas antiandrogens are simultaneously used to help suppress masculinizing features.[9] Before starting any hormone therapy, baseline laboratory tests are recommended.[11] All health care providers involved in the patient care of TGD individuals, including ATs, should have a general knowledge of the gender-affirmation process, including GAHT, surgical options, known risks and complications, and the general health needs of TGD patients.[8] Implications for how this process may affect the TGD patient's ability to exercise, compete, and work should also be discussed.

Testosterone Therapy

The primary hormone used to achieve masculinization is testosterone. The goal is to achieve hormone levels similar to the typical physiological range for cisgender men (300 ng/dL –1000 ng/dL),[8,11] with the target level being in the range of 400 ng/dL to 700 ng/dL for safety purposes.[12] Exogenous testosterone can be delivered in a variety of ways, including subcutaneous (SubQ) or intramuscular (IM) injections, long-acting injections, transdermal gels or patches, and SubQ implants.[8,12] The general guidelines, considerations, and laboratory monitoring for individuals on exogenous testosterone are outlined in Table 1.

Testosterone is commonly administered as SubQ injections every 7 to 10 days or as IM injections every 2 weeks.[8] Testosterone given SubQ or IM is typically referred to as depo-testosterone.[8] The usual weekly administration dose is 50 mg to 100 mg.[8] Individuals tend to prefer SubQ injections over IM injections as the needle to administer the dose has a smaller diameter, and the patient may experience less discomfort at the injection site. Because individuals on masculinizing testosterone therapy tend to have less body mass than cisgender men, hormone treatment often begins with lower doses and is titrated upward to avoid supratherapeutic levels.[8] However, dosing should take the individual's goals and priorities into consideration.

Transdermal gels (in packets or pumps) and patches are other frequent routes of administration for testosterone.[8] When using transdermal gel administration, the patient must keep the application site covered to avoid skin-to-skin contact with others. This can be a particular concern for athletes. Additionally, the patient should avoid showering, excessive sweating, and swimming for 2 hours after application to ensure absorption.[8] Long-acting formulations of testosterone are another option. Testosterone undecanoate is available as a long-acting injection given every 10 weeks after initial loading doses given at the

Table 1. Testosterone Therapies[13]

Medication	Medication Dosage Form	Initial or Target Dose in Adults	Comments	Laboratory or Other Monitoring
Testosterone enanthate, testosterone cypionate	Injectable	Initial 50 mg SubQ or IM/wk, then 50–100 mg SubQ or IM/wk; maximum dose = 200 mg SubQ or IM/2 wk	SubQ: 1 mL, 25-gauge, 5/8-in syringe recommended into abdomen or thigh IM: gluteal muscle	At baseline—CBC (Hgb, Hct), lipid profile, and fasting glucose Every 3 mo until in range—serum testosterone: goal range = 350–900 mg/dl
Androderm (AbbVie), 2-mg and 4-mg patches	Transdermal patch	Apply 2–8 mg/d		
Androgel Testim (ASCEND Therapeutics US, LLC)	Topical gel packets	Apply 50–100 mg/d	Application to upper arm recommended	Serum testosterone levels should be drawn midway between injections and ≥2 h after application Monitor blood pressure
Androgel (ASCEND Therapeutics US, LLC), 1% (12.5 mg/pump), 1.62% (20.25 mg/pump)	Topical gel pump	Starting dose is 2 pumps/d Apply 50–100 mg/d	Application to upper arm recommended	
Axiron 2% (Lilly USA, LLC)	Topical gel pump	1 pump to each axilla daily	Apply to axillary	
Testopel (Endo International)	SubQ implant (pellet)	8–12 pellets every 3–4 mo	Implanted into skin in upper outer quadrant of hip	
AVEED (testosterone undecanoate; Endo International)	Injectable, long acting	750 mg/3 mL every 10 wk	Inject into gluteal medius Risk of pulmonary oil microembolism during or immediately after injection	

Abbreviations: CBC, complete blood count; Hgb, Hct, hemoglobin, hematocrit; IM, intramuscular; SubQ, subcutaneous.

start of treatment and at 1 month following initiation.[8,13] Alternatively, testosterone pellets can be implanted into the patient's hip area, with effects lasting for 3 to 4 months. Pellets are long-acting implants that are reserved for hormone level maintenance and not for treatment initiation. Oral formulations of testosterone are not recommended.[14] Testosterone is a banned substance according to the National Collegiate Athletic Association (NCAA)[15] and World Anti-Doping Agency,[16] which provides the guidelines followed by the International Olympic Committee (IOC); therefore, TGD athletes on testosterone therapy should apply for a therapeutic use exemption.

Intended Therapeutic Effects

Testosterone for GAHT causes the development of secondary male sex characteristics.[8] Patients should be aware that the effects of the treatment are highly individualized and cannot be accurately predicted for each patient.[8] Within the first 3 to 6 months of treatment, individuals undergoing masculinizing therapy may experience amenorrhea, fat redistribution, increased libido, increased muscle mass, acne, and facial hair growth.[8,11] Other effects of testosterone may be pelvic pain, vaginal atrophy, and emotional changes, such as anger and irritability.[8] With a longer course of treatment, patients can experience voice deepening, clitoromegaly, and male-pattern hair loss.[8,11] If suppression of menses does not occur with testosterone alone, a 150-mg IM injection of depo-medroxyprogesterone may be added to the treatment regimen.[14] In this case, ATs should be aware of possible effects such as bone mineral density loss.[13]

Tendon injuries are common with the use of testosterone due to increased muscle mass.[12] Athletic trainers should advise patients who want to build muscle quickly to monitor strength and conditioning regimens to reduce injury.[12] It is important to note that not all secondary male sex characteristics are desired; however, desired and undesired characteristics cannot be selected or controlled.[8,11] Therefore, the patient should be educated on the full spectrum of possible results,[8,11] which emphasizes the need for informed consent and thorough discussions of both side effects and intended therapeutic effects between the interprofessional care team and the patient before starting GAHT. When hormone treatment is initiated after puberty, patients will retain some nonreversible physical feminization.[8,11] Thus, individuals assigned female at birth tend to be shorter, maintain a degree of female fat distribution, and have larger Q-angles than cisgender men.[8]

Adverse Effects and Drug Interactions

Patients using testosterone for hormone therapy should be monitored for biochemical and hematological consequences in addition to the previously described physical side effects.[8] The primary concerns are a decrease in high-density lipoprotein (HDL) cholesterol, elevated triglyceride level, and erythrocytosis.[8] A more pronounced increase in red blood cells occurs within the first 3 months of treatment,[8] so a complete blood count is recommended before starting therapy to monitor changes.[12] Per the US Preventive Services Task Force guidelines, lipid and glucose tests may be advised.[12] No studies have shown an increase in the incidence of cardiovascular events among individuals assigned female at birth taking testosterone;[17] nonetheless, other authors indicated that testosterone could influence metabolic factors associated with a higher risk of cardiovascular events.[18] Therefore, patients should be regularly monitored for indicators linked with risks of cardiovascular events.[8]

Other risks associated with the use of exogenous testosterone include sleep apnea, excessive weight gain, and salt retention.[8] To help reduce the risks, Endocrine Society Guidelines recommend monitoring testosterone levels every 3 months for the first year after initiating treatment in individuals using masculinizing hormones and after any dose adjustment.[8] Lower testosterone levels may be desired by patients who are not interested in quick or robust changes.[13] After the patient has reached a stable dose, the desired effects are met, and hormone levels are maintained within physiological ranges, testosterone levels should be checked approximately every 6 to 12 months.[8] Estradiol levels (goal range of $<$50 pg/mL) are typically not checked regularly.[8]

Estrogen and Antiandrogen Therapy

For feminization hormone therapy, the goal is to both lower testosterone levels and increase estrogen levels similar to the usual physiological range for cisgender women (100 ng/dL–200 pg/mL).[8,11] Using estrogen as the only hormone therapy will suppress androgen production; however, physiological dosing alone is frequently insufficient to suppress testosterone in individuals assigned male at birth to the physiological range for cisgender women ($<$50 ng/dL).[8,11] Thus, an antiandrogen is used to decrease testosterone levels.[8,11] Typically, patients initiate estrogen and antiandrogen therapies at the same time.[8]

Exogenous estrogen can be delivered in a variety of ways, including via oral, transdermal, and injectable routes.[8,11] Only 1 route of administration should be used at a time for replacement therapy.[11] The general guidelines, considerations, and laboratory monitoring for individuals undergoing feminization therapy are described in Table 2. Oral estrogens are easily administered and may also be taken sublingually.[4] The estradiol form is considered generally safe with few contraindications.[6] Transdermal patches are another method; a new patch(es) must be placed once or twice a week depending on the product.[8,11] Patches are usually applied to the gluteal or hip area, and application sites should be rotated.[8,11] Transdermal estradiol gel is available in a packet or pump and is applied once daily.[19] The patient should allow $\geq$20 minutes for the gel to dry and avoid showering, excessive sweating, and swimming for 2 hours after application to ensure absorption.[8,13] Finally, IM injections can also be administered. Injections are given either every 1 or 2 weeks, depending on the product. Patients undergoing feminizing hormone therapy need adjunctive therapy to lower testosterone levels to within the range of a cisgender female.[8,11] Spironolactone, the most commonly used antiandrogen in GAHT, is a potassium-sparing diuretic with antagonist effects at the androgen receptor when administered at high doses.[8,11,13] Spironolactone used for adjunctive therapy commonly starts at 50 mg twice daily. Usual doses are between 100 mg and 300 mg orally per day, yet may be lower to mitigate unwanted side effects.[13,20] Spironolactone is a banned substance according to the World Anti-Doping Agency[13] and NCAA[15]; therefore, athletes who are taking spironolactone should apply for a therapeutic use exemption.

Intended Therapeutic Effects

The treatment effects of feminizing hormone therapy vary from patient to patient. However, within the first 3 to 12 months

Table 2. Estrogens and Antiandrogen Therapies[13]

Medication	Medication Dosage Form	Initial or Target Dose	Comments	Laboratory or Other Monitoring
Estradiol	Oral tablet	2–8 mg daily	May be taken orally or sublingually If >2 mg/d, divide into 2×/d dosing	Lipid profile and fasting glucose Serum testosterone level <50 mg/dL (at 6–12 mo)
Estradiol valerate	Injectable	5–10 mg IM every 2 wk Maximum dose = 30 mg IM every 2 wk Injected into upper outer quadrant of gluteal muscle	Use 1 mL, 25-gauge, 1-in needle	Serum estradiol levels = 100–200 pg/mL Draw serum estradiol levels 2 h after oral dose and 4 h if given sublingually
Estradiol cypionate	Injectable	2–10 mg IM/wk		Draw serum estradiol levels mid-dose if given as injectable
Estradiol (Climara; Bayer) 100 mcg	Transdermal patch	Apply 1×/wk 100–400 mcg	May need >1 patch to achieve dose	
Estradiol (Vivelle-Dot; Novartis Pharmaceuticals Corp) 100 mcg	Transdermal patch	Apply 2×/wk to lower abdomen or buttocks 100–400 mcg	May need more than 1 patch to achieve dose	
Estradiol gel (EstroGel; ASCEND Therapeutics) 1.25 mg	Gel pump	Apply daily to arm from wrist to shoulder		
Estradiol gel (Divigel; Vertical Pharmaceuticals, LLC) 1.25 mg	Gel packet	Apply daily to upper thigh		
Medroxyprogesterone (Depo-Provera; Pfizer Inc)	Injectable (IM or SQ)	150 mg every 3 mo	Used for menstrual suppression	
Spironolactone[21] (Aldactone; Pfizer)	Oral tablet	50 mg 2×/d Maximum dose = 300 mg	Administer consistently, either with or without food	Baseline kidney function and potassium levels

Abbreviations: IM, intramuscular; SubQ, subcutaneous.

of estrogen and antiandrogen treatment, patients can expect to notice changes in secondary sex characteristics.[8] They may experience a decrease in facial and body hair, reduction in skin oiliness, growth of breast tissue, decreased libido, redistribution of body fat, and a decrease in spontaneous erections.[8,11] Additionally, feminizing hormone therapy will cause prostate atrophy, decreased testicular volume, and a decrease in muscle mass.[8,11] The patient may notice emotional changes, such as mood swings, an increase in sensitivity, and a general increase in emotion, which correlates with changing estrogen levels.[13,21] Similar to masculinizing hormone therapy, not all secondary sex characteristics are desired; however, desired and undesired characteristics cannot be controlled. As a result, patients should be educated on the full spectrum of possible effects.[8,11] Furthermore, if a patient begins hormone therapy after puberty, the prior effects of androgens will not be altered after treatment is initiated. This includes height, voice, and the size and shape of the hands, feet, jaw, and pelvis.[11] Estrogen therapy will not change the voice, so voice therapy or speech therapy may be options.[22]

Adverse Effects and Drug Interactions

Several medical risks are associated with feminizing hormone therapy, but the greatest concern is venous thromboembolism.[8] Deep vein thrombosis is the most significant risk and is associated with the metabolism of oral estrogen medication.[8] Other contributory factors related to an increased chance of venous thromboembolism may include smoking and immobilization.[8] For an individual assigned male at birth taking feminizing hormones, the risks of myocardial infarction and cerebrovascular events are no different from those of cisgender men or cisgender women taking estrogen as a contraceptive; still, the rate is increased compared with cisgender women not taking estrogen.[8,11]

As previously mentioned, many individuals undergoing feminizing hormone therapy take antiandrogens in addition to estrogen. Specific side effects that are associated with antiandrogen therapy should also be monitored,[8] in particular when using spironolactone, a potassium-sparing diuretic that can cause hyperkalemia and dehydration.[8,11] To help reduce risks, patients should have their blood pressure regularly monitored for hypotension[8] and appropriate hydration levels, which is a particular concern in athletes. The Endocrine Society Guidelines recommended monitoring patients' potassium levels at baseline and then at every 3 months for the first year after initiating treatment or after any dose adjustment.[8] After the patient has reached a stable dose and hormone levels are maintained within physiological ranges, levels should be checked approximately every 6 to 12 months.[8] During these routine appointments, ongoing laboratory testing and evaluation of adverse reactions to therapy should be conducted.[8] A baseline lipid profile and fasting glucose level may be obtained if warranted according to the US Preventive Services Task Force recommendations.[13]

Serum testosterone levels may be obtained between 6 and 12 months, with the goal range being that of a cisgender woman (<55 mg/dL).[13] Target serum levels for average daily serum estradiol levels should be between 100 pg/mL and 200 pg/mL.[13] The blood should be drawn mid-dose if receiving injections, 2 hours after an oral dose, or ≥4 hours after sublingual dosing.[13]

Patient Access and Regulation of Hormone Therapy

Before GAHT is started, informed consent must be discussed with the patient. This communication should include a rigorous review of the risks and benefits of treatment, the individual's goals and priorities for treatment, the setting of realistic medication goals, and the potential cost of treatment.[23] The patient should seek supportive mental health treatment in validation of personal goals, not for a diagnosis.[23] The cost of treatment varies, so individuals are encouraged to check their insurance plans because plans vary greatly from company to company. Some GAHTs are more cost-prohibitive than others, so all options should be discussed with the prescriber. Individuals who find that their insurance does not cover specific medications may investigate patient assistance programs to help with the cost. Certain medications may be covered by insurance after a prior authorization from the health care provider is received. The prior authorization process is used to determine if the medication is medically necessary for the patient's condition.

Another barrier for patients seeking GAHT may be access to care due to a lack of safety and medical care secondary to gaps in certain local and regional locations. Patients may discover a lack of providers specializing in gender-affirming care, yet GAHT need not be prescribed by an endocrinologist; pharmaceuticals can be prescribed by any primary care provider with prescribing privileges who is competent in providing care to gender-diverse populations. Another geographic barrier associated with GAHT is the necessity of ongoing laboratory testing to monitor both personal desired outcomes of GAHT and sports compliance.

Individuals are advised to use treatments that are approved by the Food and Drug Administration (FDA). Nevertheless, medications for GAHT are used off label, and patients must discuss the risks and benefits with their providers before use. *Off label* refers to the use of a medication for an indication, age group, route of administration, or dose other than that approved by the FDA. This approval and an understanding of off-label use ensures that data on the medication's effects have been reviewed and that the potential benefits outweigh the potential risks. Due to a lack of regulation by the FDA, the high risk of unintended and potentially dangerous effects, and the possible inclusion of banned substances, those who are undergoing GAHT should consult with their care team before taking dietary supplements.

It can be difficult to be aware of all possible drug interactions. As such, if ATs are unfamiliar with the potential interactions from combining GAHT and common nonprescription or over-the-counter medications, the AT should research possible interactions on a case-by-case basis. Multiple web-based interaction resources are available free of charge. Examples of databases include but are not limited to, the WebMD interaction checker (https://www.webmd.com/interaction-checker/default.htm), Medscape drug interaction checker (https://reference.medscape.com/drug-interactionchecker), and Drugs.com interactions checker (https://www.drugs.com/drug_interactions.html). If questions persist after research, assistance from a pharmacist may be warranted.

In the athletic training facility, frequent nonprescription medications provided to athletes after an assessment may include the following: pain medications, such as aspirin, naproxen, and acetaminophen; loratadine, diphenhydramine, and cetirizine for allergic reactions; and calcium carbonate, bismuth subsalicylate, famotidine, and omeprazole for an upset stomach.[13] Aspirin may diminish the therapeutic effect of spironolactone, and nonsteroidal anti-inflammatory drugs may enhance the hyperkalemic effects of potassium-sparing diuretics such as spironolactone.[13]

Gender-Affirming Surgery

Approximately half of the transgender population chooses to undergo gender-affirming surgery.[8,11] For the care of TGD patients, the World Professional Association for Transgender Health (WPATH) creates and regularly updates guidelines, which have been in place since 1979.[24] The WPATH provides criteria that should be met for any breast, chest, or genital surgery, and these criteria vary depending on the type of surgery. In general, the WPATH standards of care document recommends the following criteria be met before gender-affirming surgery: (1) persistent, well-documented gender dysphoria by a mental health professional; (2) capacity to make a fully informed decision and to consent for treatment; (3) age of majority in a given country (if younger, follow the standards of care for children and adolescents); and (4) if significant medical or mental health concerns are present, they must be reasonably well controlled.[25] Other organizations, such as the American Psychiatric Association, established their own criteria to diagnose individuals with gender dysphoria before gender-affirming interventions.[26] Regardless of the organization, individuals need to demonstrate consistent and persistent gender dysphoria before medical intervention.

For patients who have already begun GAHT, the Endocrine Society Guidelines advised that surgical interventions begin after 1 year of hormone therapy, although this is not necessarily required from a medical standpoint.[8,25] However, additional requirements may need to be met before an individual undergoes surgical intervention. For example, most insurance providers require 1 or 2 letters from mental health providers before surgery.[8,11] Furthermore, some physicians may require individuals to stop using estrogen as a part of their hormone therapy preoperatively to reduce the risk of venous thromboembolism despite evidence indicating that this is not necessary.[8,11]

When an individual decides to undergo gender-affirming surgery, several options are available for both feminizing and masculinizing surgery. Some surgical interventions that are similar to procedures undertaken by cisgender men or women, such as breast augmentation, chest reconstruction, and facial feminization, tend to have greater access, as finding a qualified surgeon is much easier.[8,11] Interventions that include genital reconstruction tend to have reduced access, as it is difficult to find these highly specialized surgeons.[8,11] Due to the complexity of these surgical procedures, it is recommended that a TGD patient find qualified specialists with relevant medical experience.[8,11]

Masculinizing Surgery

The most common masculinizing surgery is chest reconstruction. This procedure is colloquially known as *top surgery*, which can include bilateral mastectomy or male chest contouring or both.[8,11,24] Chest reconstruction is prevalent due to the gender incongruence and potential dysphoria associated with the individual having a female-contoured chest that is difficult to hide.[17] Additionally, this intervention takes medical

precedence, as chest reconstruction is regularly endorsed for cisgender men who experience enlarged breast tissue due to gynecomastia.[8,11] Other surgeries that may be chosen as part of the affirmation process include voice surgery, liposuction, lipofilling, and pectoral implants.[25]

Further masculinizing procedures involve the removal or creation or both of the pelvic reproductive organs. These procedures are colloquially known as *bottom surgery* and may involve the removal of pelvic organs, such as the uterus (*hysterectomy*), fallopian tubes and ovaries (*salpingo-oophorectomy*), and vagina (*vaginectomy*). Access to these procedures tends to be good because they are common for cisgender women.[9,11,24] Some masculinizing surgeries, such as metoidioplasty and phalloplasty, have worse outcomes, including high morbidity, so they are less commonly pursued.[8,11,27]

Nonoperative Masculinizing Intervention

Individuals may use nonsurgical interventions before or as a substitute for masculinizing surgery to align their physical appearance more closely with their gender identity. Chest binding is a frequent practice that involves using a tight compression wrap to flatten the contour of the chest. Sports bras, compression bandages, taping, or commercial binders are also often used to achieve the desired result.[17] Although chest binding may provide the individual with mental health and safety benefits, ATs should be aware of possible physical complications associated with binding,[25,28] including skin infections, musculoskeletal and neurologic pain, gastrointestinal upset, overheating, and respiratory difficulties.[28] One research team found that 88.9% of participants experienced $\geq$1 physical symptoms as a result of binding.[28] In fact, 21% of individuals reported that binding limited their activities of daily living.[28] It is important for ATs to recognize how these complications and symptoms can be exacerbated by the demands of sport. Several reputable organizations have created guides for binding, among them Children's Hospital Los Angeles (https://www.chla.org/sites/default/files/atoms/files/Binding_English%20parent.pdf) and Fenway Health (https://fenwayhealth.org/wp-content/uploads/Binding_Resource_Guide.pdf).

Feminizing Surgery

Commonly performed feminizing surgeries include facial feminization and breast augmentation, which is referred to as *top surgery*, and both procedures have good access.[8,11,24] *Facial feminization* is a broad term that can include a number of procedures, such as mandibular contouring, tracheal shaving, brow and lip lift, hairline alterations, and rhinoplasty.[8,11,24] Surgeries that involve the removal or creation or both of pelvic reproductive organs are known as *bottom surgery*. These procedures are more complex and require specialized surgeons, which reduces accessibility.[8] Feminizing genital surgery has several components, including the removal of testes (*orchiectomy*) and the removal of the penis (*penectomy*) and then the creation of a vagina (*vaginoplasty*), clitoris (*clitoroplasty*), and labia (*labiaplasty*).[8,11,24] If a gonadectomy has been performed, then antiandrogen medication is ceased, and a therapeutic use exemption is no longer necessary.[8] An orchiectomy is the most effective means of lowering testosterone levels. However, if a patient has intact testes, relatively high estrogen doses are required to suppress testosterone into the female range, even with an adjunct antiandrogen agent.[11]

Nonoperative Feminizing Intervention

Individuals may use nonsurgical interventions before or as a substitute for feminizing surgery to align their physical appearance more closely with their gender identity. A feminine chest contour can be created with soft tissue fillers such as silicone.[17] Although seemingly low risk, silicone carries potential complications, such as skin reactions, necrosis, or embolization of the silicone.[17] To create the feminine appearance of the genital region, a process called tucking is commonly used. *Tucking* involves pushing the penis and scrotum into the perineal area and moving the testicles up into the inguinal canal.[17] Once everything is in a tucked position, creating a flatter, smoother appearance, tight-fitting garments or tape can be used to maintain positioning.[17] Risks and complications of consistent tucking include skin damage, infections, inguinal hernias, urinary reflux, prostatitis, and cystitis.[29] Athletic trainers should be aware of these complications and educate the individual on the importance of taking a break from tucking. The Children's Hospital Los Angeles has created a guide for safe tucking (https://www.chla.org/sites/default/files/atoms/files/Tucking%20English.pdf).

Surgical Considerations

As part of a multidisciplinary health care team, ATs must recognize their role in providing high-quality patient-centered care. Limited data have addressed postsurgical musculoskeletal concerns in TGD athletes. The postsurgical status of a TGD patient is private information but is important to consider during an injury assessment. For example, an individual may develop chest, shoulder, or neck pain after a mastectomy, whereas pelvic floor dysfunction could be a contributing factor to hip or pelvic pain.[17] Additionally, knowing the patient's surgical affirmation status may be valuable for selecting appropriate injury-prevention equipment. For example, a TGD individual assigned male at birth may have male genitalia and should therefore still wear a protective cup if participating in a contact sport. Wearing appropriate protective equipment such as a cup is essential even if it is not considered standard protective equipment, such as in women's sports. Protective equipment precautions should be based on the individual's anatomy.[17]

Other important considerations are postsurgical rehabilitation and wound care management. As point-of-care practitioners, ATs often play a key role in postsurgical wound management by cleaning the surgical sites, monitoring for infection or complications, and rebandaging the patient. This role is particularly critical as transgender patients experience higher rates of type 2 diabetes, which can affect postoperative infection rates and healing complications.[10] Furthermore, ATs commonly initiate postoperative rehabilitation and treatments to optimize patient outcomes and reduce patient discomfort. As with any postoperative patient, ATs should follow the surgeon's treatment and rehabilitation protocol to achieve the optimal outcome.

Nutrition

Evidence-based guidelines regarding nutritional needs for TGD individuals are lacking, yet many factors must be considered when caring for this population. The transgender

population experiences a higher prevalence of disordered eating, unhealthy weight control behaviors, and body dissatisfaction.[30] Also, patients receiving gender-affirming interventions (eg, hormone replacement therapy or surgical procedures) may experience metabolic changes such as weight gain, glucose intolerance, and alterations in muscle and bone mass and creatinine levels.[31] Furthermore, increased protein and calories may be required postoperatively to promote wound healing.[31]

As a part of their transition process to help align their physical appearance to match their gender identity, TGD individuals may also make changes to their diet and exercise regimens. Although diet and exercise may play key roles in creating the desired changes, it is important to note that this population of individuals experiences higher rates of body dissatisfaction. Therefore, monitoring for unhealthy behaviors is necessary,[19] and ATs should promote healthy eating and lifestyle habits. Encouraging the patient to avoid setting specific weight or calorie intake targets creates a patient-centered approach that is more effective and helps reduce any potential triggers.[19]

For individuals undergoing GAHT, nutritional recommendations deserve specific considerations. Body composition will change when taking hormones; therefore, using gendered equations to determine energy expenditure could lead to inaccurate results.[19] To set patient goals and track progress, ATs should use gender-neutral nutrition equations and individualize objective measures. Currently, no nutritional assessment standards have been developed for the TGD population.[32] Athletic trainers may use established values related to the patient's gender identity, individualize a plan based on the stage of the patient's medical transition, or consult the range of standardized male and female values for a given assessment, such as the estimated energy requirement equation.[32] Many side effects can result from hormonal therapy: specific risks are identified by the WPATH.[30]

All individuals using GAHT should be educated on the potential side effects of their treatment. Possible side effects for individuals using testosterone include weight gain, increased lean body mass, decreased fat mass, increased hemoglobin and hematocrit levels, increased creatinine level, and changes in HDL and low-density lipoprotein levels, among others. These can lead to an overall increased risk of developing hypertension, cardiovascular disease, type 2 diabetes, and polycythemia.[30] Long-term use of testosterone can cause a decrease in bone mass, which may lead to osteoporosis.[31] Also, testosterone may considerably reduce or stop menstruation altogether, which would affect the iron needs of the individual taking masculinizing hormones.[31]

Patients receiving estrogen therapy may experience a decrease in creatinine level and an increase in bone density (especially if the testes have been removed), which is the opposite of patients using testosterone.[31] Other changes, such as weight gain, are similar; however, estrogen therapy results in an increase in fat mass and a decrease in lean muscle mass.[30] Low-density lipoprotein and HDL levels as well as blood pressure may be altered.[30] Thus, the risks of cardiovascular disease, hypertriglyceridemia, and type 2 diabetes increase overall.[30] In addition, estrogen therapy may increase the risk of thromboembolic disease.[31] As indicated in the National Transgender Discrimination Survey, transgender women were more likely to exhibit signs of eating disorders or unhealthy weight control habits.[31]

Transgender and gender-diverse individuals are at increased risk for multiple chronic diseases. Although it is important to consider how nutritional factors and GAHT may contribute to these diseases, another significant consideration is the social determinants of health. Food insecurity is a concern given the disparities in health, health care, housing, and employment accessibility for transgender people.[19] These individuals also face many challenges, such as discrimination, denial of care, lack of access to adequate housing and employment opportunities, and the overall stress of the stigma from being TGD. These results in health and health care disparities that contribute to the prevalence of chronic disease in this population.[19] Proper nutritional counseling can improve dietary choices, leading to improved glucose and lipoprotein levels and blood pressure and hemoglobin values. At the same time, reducing overall body fat lowers the overall risk of chronic disease.[30] To support TGD people in their gender-affirming journey, ATs can play a key role in educating, monitoring, and promoting a healthy lifestyle.

The AT's Role in Navigating Sport Participation

As mentioned in part 1 of this narrative literature review, ATs have an important role in the TGD patient population, especially for those who participate in sport. As point-of-care medical providers, ATs need to be well educated and prepared to not only care for the TGD patient population but assist in the medical aspects of athletic eligibility. Traditionally, ATs have played an integral role in sporting organizations by assisting with medical compliance and eligibility. Customarily, ATs have aided athletes and compliance personnel with medical exemptions by ensuring that the required paperwork is completed and collecting supporting medical documentation indicating the need for the medical exemption, such as laboratory results, dosage information, and medical history. These efforts reduce the burden on TGD athletes and assist compliance personnel in providing the appropriate information needed for a medical exemption. This aid is especially helpful as several sport-governing bodies have recently implemented changes to their transgender participation policies, and which organizations will make further changes remains unknown.[33]

The first major international acknowledgment regarding the participation of TGD athletes in organized sport occurred in 2004, when the IOC Medical Commission approved the Stockholm Consensus.[17] Following this event, other sports organizations released their own statements and policies. These initial policies were very restrictive; however, in 2015, the IOC updated its policy to become more inclusive toward TGD athletes. During this update, the IOC removed the requirement of gender-affirmation surgery or legal recognition of an athlete's gender, and, instead, hormone levels became the focus of eligibility.[17]

In recent years, the inclusion of TGD athletes in organized sports has been in the spotlight, and changing participation policies and legislation have resulted in more challenges.[33] In 2021, the IOC changed its policy by releasing its "Framework on Fairness, Inclusion, and Non-Discrimination on the Basis of Gender Identity and Sex Variations."[34] Unlike the 2015 policy, the new framework provided 10 guiding principles and placed the responsibility on the international federations and national governing bodies to create inclusive environments.[34] Whether individual organizing bodies will update their policies as they did when the IOC initially implemented its policy in 2004 or updated the original policy in 2015 remains unclear.

One of the first organizations to release a new policy after the 2021 IOC update was the NCAA.[33] In early 2022, the NCAA adopted a sport-by-sport approach to participation similar to that of the IOC. Yet a notable difference between the organizations was that the NCAA policy included mandatory testosterone testing for transgender NCAA athletes starting in the 2022 to 2023 academic year.[33] In June 2022, the Fédération Internationale de Natation, which is the international governing body for aquatic sports such as swimming, diving, water polo, and synchronized and open-water swimming, released a restrictive policy that outright banned transgender and intersex women from participating.[35] Finally, to further complicate the challenges facing TGD athletes, notable organizations such as the National Federation of High School Associations do not have a universal policy for all high schools but rather a recommendation that school administrators familiarize themselves with state statutes, state association policies, and board of education requirements. Several recent laws introduced at the state level ban transgender youth from participating in sports. Most frequently, this has occurred at schools with kindergarten through the 12th grade, but some included collegiate athletics.[36] Currently, 18 states ban students from participating in sports consistent with their gender identity.[36]

The lack of any semblance of consistency across the organizing bodies makes addressing compliance and eligibility concerns difficult as they are unique to each organization. Nevertheless, as a medical liaison and patient advocate between the individual's physicians and compliance personnel, the AT should be knowledgeable about the patient's medical history and compliance requirements for participation. Assisting in this way allows the AT and medical staff to establish a relationship and rapport with an individual undergoing GAHT treatment. Furthermore, understanding the gender-affirmation framework aids the AT in navigating the changing environment surrounding TGD participation rules and regulations. The NCAA policies are available at https://www.ncaa.org/sports/2022/1/28/transgender-student-athlete-eligibility-review-procedures.aspx and the IOC policies at https://stillmed.olympics.com/media/Documents/News/2021/11/IOC-Framework-Fairness-Inclusion-Non-discrimination-2021.pdf.

CONCLUSIONS

Currently, media attention surrounding the participation of TGD athletes in organized sports has increased.[33] In addition, several major sports organizations, including the IOC and NCAA, have recently changed their transgender participation policies to use a sport-by-sport approach, which has garnered further media attention.[33] Although this media attention is at the forefront of society, health care providers and compliance personnel work behind the scenes to adhere to the changing rules and regulations. As have other health care providers, ATs have historically lacked competence and education regarding transgender patient care and their roles within the system.[6,7,37] Often, TGD patients have described the extra burden of educating their health care providers about their individual needs, as many health care providers have not received education on these topics.[5]

This 2-part narrative literature review seeks to provide guidance for ATs and other health care providers on the medical affirmation process for TGD individuals. Furthermore, we hope to have clarified ways in which ATs, as point-of-care medical providers, can play an integral role as a patient care coordinator on an interprofessional care team and as a "point person" to assist in the medical aspects of athletic eligibility. Part 1 of this narrative literature review provided the foundational knowledge and experiences of TGD individuals in the health care system to contextualize the need for ATs to improve their care for these patients. Finally, clinicians should remain up to date on best practices, as the body of knowledge in this area is rapidly changing and expanding.

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