Analysis of Gender-Affirming Surgeries to Improve Gender Dysphoria and Quality of Life in the United States

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Abstract

Objective: To evaluate the effects of gender-affirming surgery (GAS) on quality of life and gender dysphoria (GD) among individuals in the United States.

Data Sources: A literature search was conducted using PubMed, Web of Science, APA PsycINFO, APA, CINAHL Combined, and LGBTQ+ Source from February 2017 to February 2023. Randomized controlled trials and case reports/case series that described GD, quality of life, and gender surgery in the context of the United States were included.

Study Selection: Five independent reviewers analyzed the studies; conducted screening of titles, abstracts, and full texts; resolved any disagreements through multiple rounds of review; and manually eliminated duplicate references. Reasons for exclusion were documented. The comprehensive search yielded 864 potentially relevant studies, of which 11 were included in the final analysis.

Data Extraction: For data analysis, the authors recorded information including mean age, gender assigned at birth, race, sample size, type of GAS, and measures/questionnaires used to assess GD before and after surgery, concurrent therapies, history of mental health illnesses, and postoperative complications.

Results: The results showed that after the participants received combined procedures on the face, chest, or genitalia, there was a significant improvement in self-worth, social and psychological well-being, and sexual and physical appearance satisfaction, improving overall quality of life and GD.

Conclusions: Gender identity is a complex subject, and although the research is gaining momentum, much is yet to unfold. Despite the recent increase in access to gender assignment surgeries, there is a paucity of research to assess the quality of life and GD among these individuals after surgical interventions and among individuals who have accepted themselves.

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Gender identity is one's internal sense of self and gender, whether that is man, woman, or both. Most people identify as "male" or "female" ("binary" identities).[1] Gender dysphoria (GD), previously known as gender identity disorder, refers to an intense discomfort or distress that results when a person's assigned birth gender is not the same as the one with which they identify.[1] GD can strongly impact a person's quality of life, resulting from poor peer and family relations, depression and anxiety, substance use disorders, and poor self-esteem.[1] According to the *Diagnostic and Statistical Manual of Mental Disorders*, Fifth Edition, Text Revision (*DSM-5-TR*),[2] GD prevalence accounts for 0.005%–0.014% of the population for biological males and 0.002%–0.003% for biological females. Several theories exist with regard to its etiology,[1] which suggests that it is multifactorial and involves biological factors such as hormones and genetics and psychosocial factors such as severe childhood neglect, domestic violence, and physical and sexual abuse.[3] Research shows areas of the brain that differ in transgender and nontransgender individuals, including the hippocampus and amygdala.[3]

Transgender people with GD are more likely to experience poor quality of life and mental health problems than the general population. Numerous studies have consistently shown higher rates of depression and anxiety, suicidal ideation, and substance use in the transgender population.[4–6] However, these rates have consistently decreased following successful transition, with relief from GD being reported.[7]

Clinical Points

- Individuals who undergo treatment for gender dysphoria (GD) at a younger age, including gender-affirming surgery (GAS), may experience lower rates of suicidal ideation compared to those who opt for surgery at a later age, underscoring the potential mental health benefits of timely interventions for GD.
- GAS, particularly facial feminization surgery, chest-affirming surgeries, and bottom surgeries, has been associated with significant improvements in GD, mental health, and overall quality of life, with patients reporting high levels of satisfaction and reduced rates of depression, anxiety, and suicidal ideation after surgery.
- It is essential to recognize the influence of race and ethnicity on access to and outcomes of gender-affirming therapies; barriers such as cultural views, health care disparities, and reluctance to seek care may disproportionately affect individuals from diverse backgrounds.

In recent years, the number of transgender people seeking care has increased due to an increase in social acceptance and a decrease in stigmatization of GD. Gender-affirming care is an umbrella term that encompasses social, legal, and medical interventions to support transgender persons in their gender transition. This multidisciplinary approach to care is crucial for their overall health and well-being, improvement in psychological functioning, and decreased feelings of distress. Gender-affirming care and supported social transition have also been shown to correlate with reduced rates of depression, anxiety, and suicidal ideation.[8,9]

Hormone replacement therapy, psychotherapy, and gender-affirming surgery (GAS) are vital components in treating GD. Various surgical procedures are available to treat transgender people with GD.[10] Genital surgery, or sex reassignment surgery, includes vulvoplasty, vaginoplasty, orchiectomy, facial feminization surgery in males, hysterectomy, vaginectomy, scrotoplasty, and mastectomy in females. GAS is being increasingly performed, and the results have been promising.[11] It is becoming a vital component of health care in the United States, substantially improving the quality of life, satisfaction level, and long-term mental health among the transgender population experiencing GD.[12–14]

Although there is a recent increase in access to GAS, there is a lack of research to assess GD among transgender individuals after surgical interventions. To understand the impact of GAS on the GD of individuals, we aim to evaluate the effects of GAS on GD among individuals after surgery in the United States. We provide an overview of most surgeries done in all transgender populations with GD, their demographic factors, effects of GAS on other mental health disorders, quality-of-life improvement, and complications.

METHODS

We used 6 databases, including PubMed, Web of Science, APA PsycINFO, APA, CINAHL Combined, and LGBTQ+ Source databases, for our research. The literature search included English-language–only US studies published from February 2017 to February 2023. Search terms included a combination of relevant Medical Subject Heading terms such as "Gender Dysphoria OR Gender Identity Disorder OR Cisgender OR transgender OR transsexualism" AND "Gender Affirming Surgery OR Gender Reassignment Surgery OR Sex Reassignment Surgery OR Facial Reconstructive Surgery OR Chest Surgery OR Top Surgery OR Genital Surgery OR Bottom Surgery."

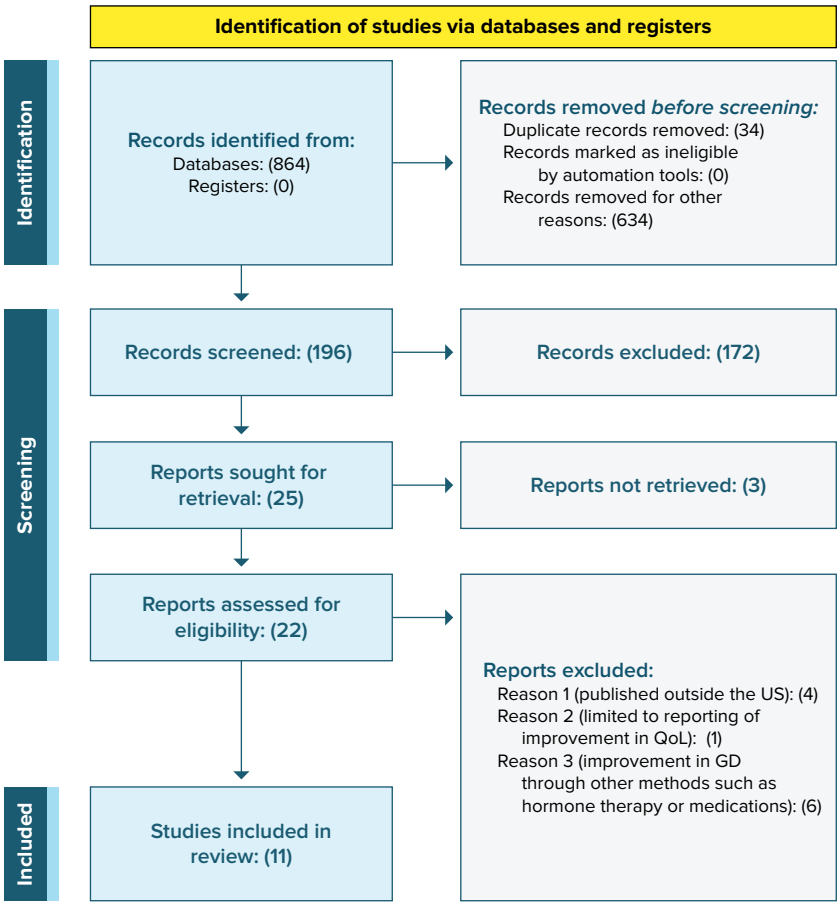
For our inclusion criteria, GD was defined as a concept designated in the *DSM-5-TR* as clinically significant distress or impairment related to an ardent desire to be of another gender, which may include a desire to change primary and secondary sex characteristics. GAS was referred to as procedures that help people transition to their self-identified gender. Gender-affirming options may include facial surgery, top surgery, or bottom surgery. GAS gives transgender people a body that aligns with their gender. It may involve procedures on the face, chest, or genitalia. Original research, including randomized controlled trials, cohort studies, case-control studies, cross-sectional studies, case series, case reports, and qualitative studies, was evaluated in our study.

We included preprints and letters if they described original research that reported data on the outcomes of GAS on reducing GD. We excluded studies published outside of the United States and those limited to reporting improvement in quality of life only or reduction in GD through other methods of gender transformation such as hormone therapy or medical therapy. Duplicate references were removed manually. Five independent reviewers screened the titles, abstracts, and full texts of the articles. Any disagreement on including a title, abstract, or full-text article was retained for the next screening stage and reviewed multiple times by the reviewers (J.S.B., S.S., A.A., M.B.). Reasons for the exclusion of full texts were collected. This comprehensive search resulted in 864 potentially relevant studies, of which 11 studies were included for the final analysis (Figure 1).

For data analysis, we recorded the mean age, gender assigned at birth, race, sample size, GAS type, type of measures or questionnaires used for GD measurement before and after the surgery, concomitant therapies used before and/or after the surgery, history of any mental health illnesses, and postsurgery complications.

Figure 1.

Preferred Reporting Items for Systematic Reviews and Meta-Analyses Flow Diagram



Abbreviations: GD = gender dysphoria, QoL = quality of life.

RESULTS

The mean sample size of participants in all studies was 182.1. The mean age of the participants was 34.7, while the mean age for males (gender assigned at birth) was 37.32 and for females (gender assigned at birth) was 30.27. Baseline demographics of the participants in all studies in our review included mean age, sample size, race/ethnicity, and gender distribution of all participants (Table 1).[13–23] Tran et al[16] noted that race was an independent predictor for complications for GAS.

The most common psychiatric disorders among participants with GD who underwent GAS were mood disorders, substance abuse, depression, and anxiety.[14,15,18,19,23] Owen-Smith et al[15] studied the depression and anxiety severities using the 10-item Center for Epidemiologic Studies Depression Scale[24] and Beck Anxiety Index[25] scores, respectively (Table 2).[13–25]

To evaluate GD among participants preoperatively and postoperatively, the studies used different questionnaires. One study[13] used the Facial Feminizing Surgery (FFS) outcome score. This instrument was adapted from a tool validated in the general facial aesthetic surgery population to assess physical, emotional, and social domains of patient satisfaction with their face.[26,27] It was then adapted for use in the transgender and gender-diverse population and underwent standard reliability validation and constitutes 9 questions scored on a 5-point Likert scale (ranging from 0 to 4, where 0 constitutes least satisfied, and 4 constitutes most satisfied).[13]

One study[19] used the 20-question adapted Female Genital Self-Image Scale[28] (FGSIS). Agarwal et al[23] used the BREAST-Q[29] and Body Uneasiness Test (BUT-A)[30] and measured breast satisfaction and psychosocial/sexual/physical well-being. Another study[17] developed and utilized the Chest Dysphoria Scale (CDS) to analyze GD before surgery. The CDS measures physical functioning, hygiene and exercise, intimate partnerships and dating, perception of gender, and disruption of the future.[17]

Table 1.
Baseline Demographics of Participants From All Studies

Study	Sample size, n	Gender assigned at birth, n (%)	Age, y	Race/ethnicity	
				Race/ethnicity	n (%)
Morrison et al[13]	66	Male	39.3 ± 11.9	. . .	. . .
Poudrier et al[14]	58	Male: 25 (43) Female: 0 (0) TGM: 38 (66) TGF: 0 (0) Gender nonconforming/other: 16 (27)[a]	33[b]	. . .	. . .
Owen-Smith et al[15]	697	Male: 350 (50.21) Female: 347 (49.79)	. . .	Non-Hispanic white Non-Hispanic black Asian/Pacific Islander Mixed race/ethnicity Other race/ethnicity Declined to respond	392 (56.2) 20 (2.9) 48 (19.1) 18 (2.6) 49 (7) 37 (5.3)
Tran et al[16]	381	Male: 171 (44.9) Female: 210 (55.1)	34.5	White Black/AA Asian American India or Alaskan Unknown or declined to respond	267 (70.1) 37 (9.7) 19 (5) 4 (1) 54 (14.2)
Olson-Kennedy et al[17]	136; postsurgical: 68; nonsurgical: 68[c]	Female	18	. . .	. . .
Chou et al[18]	121	Male	37.8	White Hispanic Multiracial Asian AA	74 (61.2) 15 (12.4) 14 (11.6) 13 (10.7) 5 (4.1)
Boas et al[19]	117	Male	38.4	. . .	. . .
Massie et al[20]	117	Male	38	. . .	. . .
Pittelkow et al[21]	145	Female	29.4	. . .	. . .
Esmonde et al[22]	58	Female	29.5 ± 7.6	White	49 (86)
Agarwal et al[23]	42	Female	27.7	White Biracial (AA/white) AA Asian	37 (88) 2 (4) 1 (2) 1 (2)

[a]Participants were asked to answer their gender identity.
[b]Mean age at the time of first GAS.
[c]Study compared GD between nonsurgical and postsurgical patients.
Abbreviations: AA = African American, GAS = gender-affirming surgery, GD = gender dysphoria, TGM = transgender male, TGF = transgender female, TGM = transgender male.

A few measures that were used to assess GD postoperatively include the FFS outcome score[26,27] (Likert score from 0 to 4, with a higher score being more satisfied), adapted FGSIS,[28] Transgender Congruence Scale (TCS),[31] and Body Image Satisfaction Scale (BISS)[13,15,19,20,32] (Table 3).[13–23,26–31]

The common transgender surgery options included were (1) facial reconstructive surgery, (2) chest or "top" surgery, and (3) genital or "bottom" surgery. Facial reconstructive surgery aims to make facial features more masculine or feminine—chest or top surgery to remove breast tissue for a more masculine appearance or enhance breast size and shape for a more feminine appearance and genital or bottom surgery to transform and reconstruct the genitalia.

Three studies[13,16,18] assessed the FFS of the participants. The FFS included scalp advancement, cranioplasty, brow lift/contouring, rhinoplasty, upper lip lift, mandibuloplasty, mandibular contouring, genioplasty, chondrolaryngoplasty, hairline lowering, hair transplantation, brow/frontal sinus setback, thyroid cartilage reduction, facelift, otoplasty, blepharoplasty, fat grafting, and various other procedures to help feminize the face.[13,18] In the studies in which participants were male and female (gender assigned at birth),[15,16] both top and bottom surgeries were done, which included top surgeries (eg, mastectomy or breast augmentation), partial bottom surgeries (eg, hysterectomy without vaginectomy or orchiectomy without vaginoplasty), and definitive bottom surgeries (eg, vaginectomy or vaginoplasty).[15,16] The most common complications for surgery were major and minor wound complications, wound infection, hematoma, required revision, hypertrophic scarring, deformity, granulation tissue,

Table 2.
Psychiatric Comorbidities Prevalent Among Participants With GD Who Underwent GAS

Study	Psychiatric comorbidities		Suicide attempt (yes/no), n (%)
	Diagnoses	n (%)	
Morrison et al[13]	. . .	. . .	. . .
Poudrier et al[14]	Depression, anxiety, and/or another mental health condition related to GD	47 (81)	No
Owen-Smith et al[15]	Depression; anxiety[a,24,25]		. . .
Tran et al[16]	. . .		. . .
Olson-Kennedy et al[17]	. . .		. . .
Chou et al[18]	Mood disorders	51 (42.1)	No
Boas et al[19]	Sexual abuse[b] Physical abuse[c] Substance abuse[d]	20 (47) 28 (36) 18 (15.5)	Yes, 20 (29.4)[e]
Massie et al[20]	Sexual abuse[b] Physical abuse[c] Substance abuse[d]	20 (47) 28 (36) 18 (15.5)	Yes, 20 (29.4)[e]
Pittelkow et al[21]	. . .	. . .	No
Esmonde et al[22]	. . .	. . .	No
Agarwal et al[23]	Anxiety Anxiety and depression Depression Other	5 (14) 11 (26) 2 (5) 2 (5)	. . .

[a]Study compared the severity of anxiety and depression between participants with GD who underwent GAS and who did not use the 10-item Center for Epidemiologic Studies Depression Scale and Beck Anxiety Index scores.
[b]Of 74 who responded.
[c]Of 76 who responded.
[d]Of 116 who responded.
[e]Of 68 who responded.
Abbreviations: GAS = gender-affirming surgery, GD = gender dysphoria.

scarring, vaginal stenosis, necrosis, prolonged pain, urinary tract infection (UTI), deep venous thrombosis, pulmonary embolism, and loss of nipple sensation[13,16–21,23] (Table 4).[13–23]

DISCUSSION

The *DSM-5-TR* provides 2 criteria for defining GD described as a marked incongruence between one's experienced/expressed gender and assigned gender of at least 6 months' duration, along with association with clinically significant distress or impairment in social, occupational, or other key areas of functioning.[2] Research suggests that individuals who undergo treatment for GD at a younger age have lower suicidal ideation than those who get GAS at a later age.[33]

GD treatment includes hormonal therapy, GAS, and psychological counseling. In this article, we specifically reviewed GAS as a part of treatment for GD. Literature that assesses the effect of GAS on GD is sparse. Many studies or literature have explored quality of life and patient satisfaction after surgery, showing improvement in GD after specific surgeries or surgeries in transgender males or females, not both.

Our review evaluated 11 studies that concluded that GD improved or resolved along with other mental health disorders, eg, alcohol use, tobacco smoking, and suicidal ideation or suicide attempt. Akhavan et al[34] reported that quality of life improved after vaginoplasty. Patients also reported satisfaction with GAS and with their sexual health after GAS.[34] Another review[35] done in adolescents and adults reported that overall postsurgical body satisfaction was reported in 60% of transgender males (40% felt neutral) and 100% of transgender females. The authors[35] reported a reduction in GD after GAS and that the number of GAS procedures directly corresponded with improvement in dysphoria. Depression, suicidality, and anxiety rates also showed improvement post-GAS.[35] In a systematic review and meta-analysis of quality of life and psychosocial outcomes in transsexual people,[36] researchers verified that sex reassignment with hormonal interventions was more likely to correct GD, psychological functioning and comorbidities, sexual function, and overall quality of life than sex reassignment without hormonal interventions. However, there is a low level of evidence for this.[36] The most frequent type of surgery in our review was FFS, followed by chest-affirming and penile inversion vaginoplasty (PIV) surgeries.

Table 3.

Summary of Primary GAS, Instruments Used, GD Improvement, and Adjunct Therapy

Study	Primary GAS performed	Instrument(s) (for measures/ questionnaires) used for GD before surgery	Constructs measured before surgery	GD before surgery	Outcomes instrument(s) (for measures/ questionnaires) used to measure GD after surgery	GD after surgery	Constructs measured after surgery	Medical therapy along with surgery, n (%)
Morrison et al[13]	FFS	FFS outcome score[26,27] (which includes patient satisfaction with facial feminization surgery)	Previous gender affirmation and FFS, perception of their facial features, gender appearance score, photogrammetric analysis of outcomes for FFS pre- and postoperative comparisons, general aesthetic outcome	Yes	FFS outcome score[26,27] (which includes patient satisfaction)	Improved	Gender appearance score, photogrammetric analysis of outcomes for facial feminization surgery pre- and postoperative comparisons, general aesthetic outcome	HT, 63 (95.5)
Poudrier et al[14]	Masculinizing top surgery (masculoplasty)	Self-made survey	Self-confidence, confidence in social setting, attractiveness, comfort in clothes, satisfaction with body, emotionally healthy, sexual confidence	Yes	Self-made survey	Improvement in GD-related mental health conditions reported (86%) (n = 50)	Self-confidence, confidence in social setting, Attractiveness, comfort in clothes, satisfaction with body, emotionally healthy, sexual confidence	Preoperative HT, 46 (81)
Owen-Smith et al[15]	Top and bottom surgeries	. . .	History of GAT, body-gender Congruence, body image satisfaction, depression, and anxiety	Yes	TCS,[31] BISS[32]	As the extent of GAS increased (from no treatment to definitive bottom surgery), TCS[31] and BISS[32] scores also increased (ie, were more favorable)	. . .	HT, 428 (98.39)[a]
Tran et al[16]	Face, top, and bottom surgeries	. . .	. . .	. . .	. . .	. . .	. . .	. . .
Olson-Kennedy et al[17]	Masculinizing top surgery (masculoplasty)	CDS[17]	Physical functioning, hygiene and exercise, intimate partnerships and dating, perception of gender, disruption of future plans	CDS[17] score: 29.6 in nonsurgical[b]	CDS[17]	CDS[17] score: 3.3 in postsurgical[b]	Physical functioning; hygiene and exercise; intimate partnerships and dating; perception of gender; disruption of future plans	TT, postsurgical, 66 (97); nonsurgical, 59 (87)[b]
Chou et al[18]	FFS	. . .	Medical and surgical comorbidities (single comorbidity, mood disorder, cardiovascular, pulmonary, active smoking, HIV, autoimmune, diabetes, anticoagulation use, preoperative procedures)	Yes	. . .	. . .	Follow-up and complications	. . .

(continued)

Table 3 (continued).

Study	Primary GAS performed	Instrument(s) (for measures/ questionnaires) used for GD before surgery	Constructs measured before surgery	GD before surgery	Outcomes instrument(s) (for measures/ questionnaires) used to measure GD after surgery	GD after surgery	Constructs measured after surgery	Medical therapy along with surgery, n (%)
Boas et al[19]	PIV	20-question adapted FGSIS[28]	. . .	. . .	20-question adapted FGSIS[28]	Resolution in 77% of patients (with revision) and 69% of patients (without revision)	. . .	HT, 104 (89)
Massie et al[20]	PIV	. . .	. . .	. . .	Online 20-question survey developed from FGSIS[28]	The majority of respondents (71%) indicated "resolution of their gender dysphoria"	Yes and no answer to "My dysphoria is resolved"	HT
Pittelkow et al[21]	Masculinizing top surgery (masculoplasty)	—	Age, BMI, and comorbidities (HTN, diabetes, smoking, asthma, cardiac disease), infections postsurgery, and outcomes	Yes	. . .	Improved	. . .	. . .
Esmonde et al[22]	Masculinizing top surgery (mastectomy)	Likert scale	QoL, comfort with exercise, sexual well-being, comfort in physical appearance with and without clothes (body image), comfort with exercise	. . .	Ad hoc questionnaire	Improvement in all constructs	Postoperative satisfaction with their appearance, quality of life, body image, comfort with exercise, and sexual well-being	TT, 37 (64)
Agarwal et al[23]	Masculinizing top surgery (masculoplasty)	BREAST-Q[29] and BUT-A[30]	Breast satisfaction, body image, psychosocial well-being, physical well-being, sexual satisfaction	Yes, 17.4 ± 14.0 BREAST-Q score[29]	BREAST-Q[29] and BUT-A[30]	BREAST-Q[29] score improved to 85.0 ± 11.7; BUT-A[30] scores improved	Breast satisfaction, psychosocial/sexual/ physical well-being, with improved scores in all constructs	HT, 39 (93)

[a]Of N = 435 who underwent GAS.
[b]Study compared GD between nonsurgical and postsurgical patients.
Abbreviations: BISS = Body Image Satisfaction Scale, BMI = body mass index, BUT-A = Body Uneasiness Test, CDS = Chest Dysphoria Scale, FFS = facial feminizing surgery, FGSIS = Female Genital Self-Image Scale, GAS = gender-affirming surgery, GAT = gender-affirming therapy, GD = gender dysphoria, HT = hormone therapy, HTN = hypertension, PIV = penile inversion vaginoplasty, QoL = quality of life, TCS = Transgender Congruence Scale, TT = testosterone therapy.

Male-to-Female Surgeries

Face surgeries (facial feminization surgeries). We found that FFS significantly improved quality of life and GD, while another study[34] reported that facial feminization significantly improved quality-of-life measures, but they did not measure presurgical and postsurgical GD.

Morrison et al[13] used the FFS outcome score to determine satisfaction with their FFS. Another review[36] reported the use of many validated instruments like the Short-Form Health Questionnaire, Body Image Scale,[37] Hospital Anxiety and Depression Scale,[38] Sheehan Disability Scale (validated in the general population),[39] and TCS (validated in the transgender population). Notably, 1 study in this review also used computed tomography and 3-dimensional photography to quantify postsurgical changes objectively.

Chou et al[18] reported complications with FFS, and the most common were minor wound complications (14.9%) and epistaxis (2.5%), with a return to the emergency department rate of 9.9%. Morrison et al[13] reported hypertrophic scarring, orbital emphysema, and hematoma in 4 of 20 patients. Another review[40] reported serious but temporary complications like facial numbness in 6 studies, with a reoperation rate of 4.1%.

Top surgeries (chest-affirming surgeries). We found that male-to-female chest-affirming surgeries improved GD and depression rates after GAS. Akhavan et al[34] also found a similar finding, with improvements in BREAST-Q and breast satisfaction and psychosocial and sexual well-being post-GAS.

Table 4.

Postoperative Complications of Gender-Affirming Surgery

Author	Primary GAS	Postoperative complications	N (%)
Morrison et al[13]	FFS	Hypertrophic scarring	2 (3)
		Orbital emphysema and hematoma	4 (6)
		Nasal hematoma and epistaxis	2 (3)
		Alopecia	1 (1.5)
		Iatrogenic jowling or "witch's chin" deformity after bony manipulation	1 (1.5)
Poudrier et al[14]	Masculinizing top surgery (masculoplasty)	—	—
Owen-Smith et al[15]	Top and bottom surgeries (FtM and MtF)	—	—
Tran et al[16]	Face, top, and bottom surgeries (FtM and MtF)	Overall complication	21 (5.5)
		Reoperation	11 (2.9)
		Readmission	9 (2.4)
		Infection	9 (2.4)
		UTI	4 (1)
		Superficial	4 (1)
		Bleeding	1 (0.3)
		PE/DVT	1 (0.3)
		Organ space SSI	1 (0.3)
Olson-Kennedy et al[17]	Masculinizing top surgery (masculoplasty)	Loss of sensation in other areas of the chest	29 (41)
		Long-term loss of nipple sensation	22 (32)
		Keloid (excessive) scarring	10 (15)
		Unequal chest appearance	9 (13)
		Postoperative hematoma	7 (10)
		Postoperative pain beyond normal healing time	6 (9)
		Nipple/areola(s) too large	5 (7)
		Complications related to anesthesia	5 (7)
Chou et al[18]	FFS	Any complication	35 (28.9)
		Minor wound complication	18 (14.9)
		Return to ED within 30 days	12 (9.9)
		Epistaxis	3 (2.5)
		Major complication	8 (6.6)
		Wound infection	3 (2.5)
		Ophthalmologic	3 (2.5)
		PE	1 (0.8)
		Pulmonary edema	1 (0.8)
Boas et al[19,a]	PIV	UTI	8 (14.1)
		Granulation tissue	30 (67.2)
		Intravaginal scarring	11 (33)
		Prolonged pain	22 (40.2)
		Urinary issues	19 (21.7)
		Prolonged swelling	16 (28.3)
		Sexual activity–related complication	19 (21.7)
		Necrosis	20 (30.2)
		Hematoma/excessive bleeding	12 (21.1)
		Complete vaginal stenosis	24 (55.3)
Massie et al[20,a]	PIV	UTI	8 (14.1)
		Granulation tissue	30 (67.2)
		Intravaginal scarring	11 (33)
		Prolonged pain	22 (40.2)
		Urinary issues	19 (21.7)
		Prolonged swelling	16 (28.3)
		Sexual activity–related complication	19 (21.7)
		Necrosis	20 (30.2)
		Hematoma/excessive bleeding	12 (21.1)
		Complete vaginal stenosis	24 (55.3)
Pittelkow et al[21]	Masculinizing top surgery (masculoplasty)	Required revision	9 (6)
		Infection	7 (4.8)
		Postoperative pneumothorax	2 (1.3)
		Hematoma	1 (0.6)
Esmonde et al[22]	Masculinizing top surgery (masculoplasty)	Aesthetic concerns requiring revision surgery	2 (3)
		Infection requiring oral antibiotics	2 (3)
		Seroma	1 (3)

(continued)

Table 4 (continued).

Author	Primary GAS	Postoperative complications	N (%)
Agarwal et al[23]	Masculinizing top surgery (masculoplasty)	Revisions	2 (5)
		Seroma	3 (7)
		Hematoma	4 (5)

[a]Of 116 who responded.
Abbreviations: ED = emergency department, FFS = facial feminizing surgery, FtM = female-to-male, GAS = gender-affirming surgery, MtF = male-to-female, PE/DVT = pulmonary embolism/deep vein thrombosis, PIV = penile inversion vaginoplasty, SSI = surgical site infection, UTI = urinary tract infection.

One study[15] used the TCS to measure body congruence, a validated scale to measure a transgender person's level of comfort with gender identity, and the BISS to measure body image satisfaction, a subset of the previously validated revised physical self-perception profile.[41] In the review by Oles et al,[40] the only validated measure used to assess outcomes for chest feminization was the BREAST-Q (1 study). However, the BREAST-Q is not validated in the transgender population.[40] Capsular contracture, implant extrusion, and major hematoma were some of the complications.[40]

Bottom surgeries. Current vaginoplasty techniques include PIV, intestinal segment, nongenital skin flaps and/or grafts, and peritoneal flaps. While Akhavan et al[34] suggest that patients report up to 80% satisfaction with PIV surgery and postoperative sexual function, an inverse association exists between the severity of complications and patient satisfaction. In 3 of 4 studies,[15,16,19,20] the PIV surgery improved GD. Hadj-Moussa et al[42] found that in selected patients, GAS alleviated GD. In a review of GAS in adolescent transgender females, of 5 articles reviewed, 3 found that females who underwent vaginoplasty reported alleviation of GD and improved psychological functioning.[35]

In our review, studies measured postoperative satisfaction with PIV using the online 20-question adapted FGSIS,[28] TCS,[31] and BISS.[15,16,19,20,32] Oles et al[43] found that 75 studies used an outcomes instrument to measure postoperative results. Forty studies used ad hoc instruments, while 35 used instruments validated only in the cisgender population. Some of the scales used were the Female Sexual Function Index,[44] FGSIS,[28] and BISS.[32]

Massie et al[20] noted common complications such as granulation tissue, intravaginal scarring, complete vaginal stenosis, and other minor complications. Oles et al[43] found that the intraoperative rectal injury rate was 2.4%, with injuries to the urethra, bladder, or vasculature only occasionally reported. The incidence of wound dehiscence was 12.0%, and the incidence of major infection was 2.1%.[43]

Female-to-Male Surgeries

Face surgeries (facial masculinizing surgeries). Patients with GD may desire masculine facial features that cannot be achieved with hormone therapy alone. Literature on facial masculinizing surgery is extremely sparse, and the outcome studies of such surgeries are even less common. Of 15 studies included in a 2019 review,[45] only 2 reported outcomes of facial masculinizing surgery. Although the studies in the review did not use a quantifiable approach, the patients were satisfied overall with facial masculinizing surgeries.[45]

No studies in our review used instruments to measure GD pre- and postfacial masculinization surgeries. Another review[45] of facial masculinization surgery also reported that no questionnaires were used to assess surgical benefits but overall reported positive patient outcomes and no complications.

Top surgeries (chest-affirming surgeries). Seven studies[14–17,21–23] assessed female-to-male chest-affirming surgeries and showed improvement in GD in 6 studies.[14,15,17,21–23] Akhavan et al[34] showed that patient satisfaction and quality-of-life improvement are high, with significant improvement in BODY-Q scores[46] postoperatively. In a review of adolescent transgender men with GD,[35] GAS reduced GD significantly and improved psychological functioning in patients undergoing bilateral mastectomy or chest wall masculinizing procedures.

The studies in our review used various scales to assess GD postsurgically. Poudrier et al[14] used a self-made survey, Owen-Smith et al[15] used the TCS,[31] Agarwal et al[23] used the BREAST-Q[29] and BUT-A[30] scales, and Olson-Kennedy et al[17] developed and used the CDS.[17] In another review,[40] 10 validated instruments were used including the BODY-Q chest module,[46] BREAST-Q, BUT-A, and ad hoc questionnaires (1 study).

Most complications were infection, hematoma, postoperative pneumothorax, seroma, surgical revisions, temporary/permanent loss of nipple sensation, loss of sensation in other areas of the chest, and unequal chest appearance.[17,21] In the study by Oles et al,[40] the rate of major hematoma of the breast per patient was 3.9%, with a rate of reoperation secondary to complications of 6.2%. A review[34] of all GAS types reported that chest masculinizing surgeries reported the same risk profile as mastectomy in cisgender males and females with a reoperative rate of 3.2%. Hematoma as a complication is more commonly seen in minimal access techniques.[34]

Bottom surgeries. One study[15] observed that bottom surgeries significantly improved GD among patients. Similarly, Akhavan et al[34] found that patients who underwent phalloplasty reported up to 85% satisfaction. Three of five studies reviewed by Sayegh et al[45] reported improvement in GD after some type of bottom surgery (phalloplasty, hysterectomy, and ovariectomy). Another review[43] reported 89.6% patient satisfaction with phalloplasty, 91.3% reported satisfaction with

metoidioplasty, and 2 of 23 studies reported overall satisfaction with zero regrets.

Owen-Smith et al[15] used the TCS[31] to measure GD postoperatively. In another review,[43] 13 instruments used in 15 studies either were not formally developed or were not validated in transgender individuals, including the Patient Observer Scar Assessment Scale[47] and International Prostate Symptom Score[48] for phalloplasty.

Infection, UTI, and pulmonary embolism/deep vein thrombosis are some of the complications noted by Tran et al.[16] Akhavan et al[34] found that with metoidioplasty, urological complications are common, while stricture and testicular complications were less common. Some dissatisfied patients converted to phalloplasty postoperatively. Risks of phalloplasty included urethral stricture, urethral fistula, and partial and total flap loss. Similarly, another review[43] reported complications such as urethral issues and incontinence with phalloplasty. In addition, complications of metoidioplasty included urinary fistulas as well. Other complications of hysterectomy/oophorectomy/colpectomy were urinary retention, UTI, urinary frequency, and pain.

Genital confirmation surgery was more common in white transgender males than white transgender females.[49] Most of the participants had used hormonal therapies before affirmation surgeries.[49] The prevalence of GAS in transgender males was 42%–54%, while that in transgender females was around 28%.[50]

Among Asians, due to reluctance and conservative behaviors regarding sex, the population was rare to present to the health care site and had higher dropout rates than whites regarding GAS.[51] Among Koreans in the United States, cost, negative experiences in health care settings, lack of specialized health care professionals and facilities, and social stigma against transgender people were some of the barriers preventing them from safe and accessible gender-affirming therapies.[51]

Other scales used to assess GD were the Utrecht Gender Dysphoria Scale[52] (UGDS) and the Gender Identity/Gender Dysphoria Questionnaire for Adolescents and Adults[53] (GIDYQ-AA). The UGDS assesses GD regarding gender identity and gender role, while the GIDYQ-AA includes subjective, somatic, social, and sociolegal aspects.[54] Olson-Kennedy et al[17] developed and used the CDS[17] to assess GD before surgery. The CDS measured physical functioning, hygiene and exercise, intimate partnerships and dating, perception of gender, and disruption of the future. Another review[55] used the CDS to assess GD and found that among transmasculine individuals who underwent chest-reforming surgeries, the satisfaction levels were as high as 97%, while the regret rate was <1%. Unger[56] corroborated that hormonal therapy is integral to treating GD during transition. It showed a positive outcome in patients with GD.

The same was confirmed by Telang,[57] who stated that forehead contouring and jaw reshaping remained the most requested among all procedures. In most of the studies, GAS had a positive outcome, except for 2 studies that did not mention the improvement in GD.[16,18] The same was concluded by Telang,[57] who found that all patients who underwent GAS reported satisfaction with the overall outcome, with an improvement in the feeling of congruence. Also, the mental health of people who received GAS improved (as measured by the Kessler Psychological Distress Scale[58]). GAS also improved binge alcohol use, tobacco smoking, and suicidal ideation or suicide attempt.[59] A dissatisfaction rate of 7.7% among transgender females after GAS was observed in one study,[60] mainly because of the large clitoris, recurrent fistulas, and no depth in the neovagina. Also, 26.92% of participants had undergone aesthetic touch-ups in rectovaginal fistulas and vaginal and urethral structures to repair complications.[60] Among transgender females, labiaplasty followed by clitoroplasty was the most required cosmetic revision surgical procedure according to Unger.[56] The quality-of-life measure 15 years post-GAS with the King's Health Questionnaire[61] found quality of life to be lower in the domains of general health, role limitation, physical limitation, and personal limitations.[62]

Bustos et al[63] found that the most common complications were fistulas, stenosis/or strictures, tissue necrosis, and prolapse. The patient regret rate was around 2% among other studies.[63] Sigurjonsson et al[64] found that most major complications, such as deep infection, rectovaginal fistula, and pulmonary embolism, were rare. Minor complications affected approximately 25% of patients. The most common minor complications were bleeding and infection.[64]

Postoperative complications could be prevented by patient education. To avoid secondary procedures, surgeons could work with the patient ahead of time to avoid noncompliance.[65] Preoperative planning is important to recognize the lack of available local genital tissue (genital hypoplasia caused by early puberty blockers and shortened penile skin tube after aggressive circumcision) and to have an informed discussion with the patient. Another study[66] stated that race was an independent predictor of important short-term postoperative outcomes in GAS and found that black patients had more 30-day postoperative short-term complications than their white counterparts. A few measures that were used to assess GD postsurgery included the FGSIS,[28] TCS,[31] and BISS.[15,19,20,32]

Limitations

FFS has a smaller body of literature, though interest in FFS among academic plastic surgeons is rapidly increasing. We also did not include nonsurgical feminization with laser hair removal,

fillers, and chemoparalytics in our considerations. However, FFS is not limited to feminization, and no literature on facial masculinization procedures was available at the time of this writing. Despite its popularity among transgender females, breast augmentation has the least data of all GAS procedures. In our review, most of the population was white. While a few studies show disparities between the races, the literature indicates that black patients suffer from higher rates of postoperative complications than their white counterparts, and the surgery rates of Asian individuals are lower than their white counterparts.

The studies in our review had a short (6 months to a maximum of 2 years) follow-up post-GAS, which may not be sufficient to examine long-term outcomes and patient satisfaction with GAS and the resolution of GD. Many of the studies lack randomization and control groups, making the evidence level weaker and the results susceptible to bias. Our study included individuals based only in the United States; hence, it is difficult to extrapolate this evidence to the transgender population in other countries.

Future Implications

Further investigations are required to explore the impact of race and ethnicity on GAS. Additionally, there is a need for more studies employing standardized assessments to evaluate the overall quality of life following GAS. Thus far, there is a lack of standardized and validated satisfaction questionnaires specifically designed for the transgender population. It is a common practice to administer World Health Organization quality-of-life surveys before and after reconstructive surgeries to alleviate GD in transgender patients. Surgeons conducting such operations should consider implementing this approach in the future. Ongoing studies are focused on developing a comprehensive patient-reported outcome measure for the transgender and gender-diverse community. A reliable metric is essential to accurately assess and replicate patient-reported outcomes for transgender and gender-diverse individuals after undergoing GAS.

To enhance patient response rates and capture a broader range of answers, future studies should consider integrating free-text responses alongside questionnaires. Furthermore, it is essential to conduct additional research to investigate the long-term outcomes of revision labiaplasty and clitoroplasty comprehensively. This can be achieved through prospective studies with large sample sizes and extended follow-up periods, enabling a thorough evaluation of these aspects before and after gender-confirming treatment.

A crucial aspect that requires assessment is the rate of regret or disappointment among transgender adolescents who undergo GAS, such as chest wall masculinization in transgender males or vaginoplasty in transgender females, before reaching the age of 18 years. A comparative analysis should be conducted between those who undergo these procedures at an earlier stage and those who opt for them later in life. Additionally, it is important to explore and evaluate alternative surgical techniques for transgender females who have undergone puberty suppression during early puberty and may have inadequate penile tissue for PIV. Finally, comparing surgical complication rates between transgender adolescents expressing a desire and meeting the eligibility criteria for GAS before the age of 18 years and those who undergo surgery in adulthood is of significant relevance.

CONCLUSION

People with GD feel trapped in the wrong body, their minds and bodies are uncoordinated, and they are always looking for liberation and rehabilitation. Our study shows that the effectiveness of gender reassignment surgery in treating GD has encouraging implications. Gender reassignment surgeries should be affordable and supported by insurance companies for children aged <18 years to reduce the development of not only GD but also depression, anxiety, and the risk of suicide. The postoperative complications could be reduced with better surgical techniques. Many of the studies included in our literature review primarily analyzed white demographics. This shows that GD has been understudied, underdiagnosed, and undertreated in the underrepresented minorities in the United States, potentially due to religious or cultural views. One of the primary limitations noted in most of the research on transgender issues and GD is the lack of inclusion of ethnic and racial minorities within samples; it is common for studies to report samples that are 80% or more white. Another key limitation identified in our study is the relatively short follow-up duration in the studies we reviewed, ranging from 6 months to a maximum of 2 years post-GAS. This limited follow-up period may not provide a comprehensive understanding of the long-term outcomes and patient satisfaction associated with GAS, as well as the resolution of GD. It is crucial to recognize that the effects of these surgeries may continue to evolve over time. Therefore, future research should prioritize extended follow-up periods to provide a more accurate assessment of the sustained benefits and potential challenges faced by individuals post-GAS.

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