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ORIGINAL ARTICLE BODY CONTOURING

Masculinizing Chest Reconstruction in Transgender and Nonbinary Individuals: An Analysis of Epidemiology, Surgical Technique, and Postoperative Outcomes

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Abstract

Background Chest reconstruction ('top surgery') is an important component of transition in the transmasculine population that can substantially improve gender incongruence. The aim of this study was to evaluate the demographic characteristics, surgical technique, and postoperative outcomes following transmasculine chest surgery.

Methods Using ICD codes, we identified all cases of gender-affirming transmasculine chest surgery from the ACS NSQIP database (2010–2017). CPT codes were used to categorize patients by reconstructive modality: reduction versus mastectomy (± free nipple grafting [FNG]). Univariate analysis was conducted to assess for differences in demographics, comorbidities, and postoperative complications. Multivariable regression analysis was used to control for confounders.

Results A total of 755 cases were identified, of whom 591 (78.3%) were mastectomies and 164 (21.7%) were reductions. No significant differences were noted in terms of age or BMI. Mastectomies had shorter operative times, but similar length of stay compared to reductions. Rates of postoperative complications were low, with 4.7% ($n = 28$) of mastectomies and 3.7% ($n = 6$) of reductions experiencing at least one all-cause complications. Postoperative complication rates were not statistically different between mastectomy with (3.4%) and without (5.6%) FNG. After controlling for confounders, there was no difference in terms of risk of all-cause complications between reduction and mastectomy, with or without FNG.

Conclusion Mastectomy and reduction mammaplasty are both safe procedures for chest reconstruction in the transmasculine population. These results may be used to encourage shared decision making between patient and surgeon such that the reconstructive modality of choice best aligns with the desired aesthetic outcome.

Level of Evidence IV This journal requires that authors assign a level of evidence to each article. For a full description of these Evidence-Based Medicine ratings, please refer to the Table of Contents or the online Instructions to Authors www.springer.com/00266.

Keywords Gender affirmation surgery · Top surgery · Mastectomy · Reduction mammaplasty · Transmasculine

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Disclaimer The ACS NSQIP databases are the source of information used in this study. Data extrapolated, statistical analysis performed, and conclusions reached have not been verified by the ACS NSQIP but rather are the result of the work done by the authors of this study.

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Introduction

Gender incongruence refers to the discrepancy between one's experienced or outward expression of gender and their birth-assigned sex (Table 1) [1]. Roughly 0.6% of the global population identifies as transgender or gender nonbinary (TG/NB) [2], a term used to describe individuals whose gender identity falls outside the traditional, binary understanding of gender as being either male or female. Many TG/NB individuals use medical and/or surgical treatments to address dysphoria related to gender incongruence.

Gender affirmation surgery (GAS) is often an integral component of therapy in TG/NB individuals [1]. For patients identifying on the transmasculine spectrum, those assigned female at birth with a more masculine gender identity, chest reconstruction ('top surgery') is often the first and arguably the most important surgical intervention [3]. According to the 2015 US Transgender Survey, 97% of transmasculine individuals reported that they either have had or may someday want to have chest masculinization surgery [4]. In addition to facilitating improvements in chest dysphoria, psychosocial well-being, and sexual satisfaction [5–7], chest masculinization improves the ability of many patients to live continuously in a congruent gender role, which is a prerequisite for genital reconstruction [1].

Improvements in social acceptance along with recent landmark legislative rulings affecting insurance coverage [8] have enabled wider access to care. This, in turn, has led to a rise in the number of patients seeking GAS [9], for which the most commonly requested procedure is chest masculinization [10]. Although the literature on masculinizing chest reconstruction has increased in parallel with these sociopolitical paradigm shifts [11], there is still debate regarding the optimal approach to chest contouring.

Table 1 Definition of select terms related to transgender health

Term	Definition
Gender	The social construction of maleness, femaleness, and/or other recognized genders. Genders consist of a collection of attitudes, feelings, and behaviors that are usually, but not always, associated with a particular biological sex
Gender identity	A person's intrinsic sense or experience of oneself being male (a boy or a man), female (a girl or woman), or an alternative gender that is a mix of the two (gender nonbinary/gender fluid), neither (agender/neutrois), or something else entirely (e.g., third gender, hijra, other culturally specified gender)
Gender expression/gender role	Personality, appearance, interests, and behavioral expressions of one's gender identity. These are highly culturally and temporally specific
Sex	A person's biological status (chromosomal, hormonal, gonadal, genital) as male or female. An individual's sex assigned at birth (birth-assigned sex), usually based on the appearance of the external genitalia
Cisgender	Adjective to describe a person whose gender identity corresponds with that expected for their sex assigned at birth
Transgender	Adjective to describe a diverse group of individuals whose gender identity differs to varying degrees from that which is usually associated with the sex they were assigned at birth. People who are transgender may cross, transcend, or otherwise disrupt culturally defined categories of gender and often experience a degree of gender incongruence
Gender nonconforming	Adjective to describe individuals whose gender identity, role, or expression differ, from what is normative for their assigned sex in a given culture and historical period
Gender nonbinary	Term used to describe individuals whose gender identity transcends the male/female (binary) understanding of gender
Genderqueer	Term used to self-describe by some individuals whose gender is fluid, nonbinary, or otherwise "queers" the understanding of gender
Gender incongruence	Discordance between a person's gender identity and the gendered structures of their body
Gender dysphoria	Discomfort or distress caused by a discrepancy between a person's gender identity and that person's sex assigned at birth (and the associated gender role and/or primary and secondary sex characteristics)
Gender affirmation surgery/sex reassignment surgery	Surgery to change primary and/or secondary sex characteristics to affirm a person's gender identity. Sex reassignment surgery can be an important part of medically necessary treatment to alleviate gender dysphoria
Sexual orientation	Who one is sexually attracted to. Sexual orientation is not related to gender identity

Furthermore, much remains to be explored in relation to the complication profiles of the various surgical techniques.

Broadly, surgical options for chest masculinization fall into two categories: approaches similar to mastectomy employed for cancer prophylaxis and treatment of gynecomastia [12–14], and those resembling traditional breast reduction techniques [15], notwithstanding technical modifications to optimize the desired aesthetic outcome.

Mastectomy is generally believed to allow for a better approximation of the male chest contour than reduction [11, 16–18] and thus has gained popularity. However, reduction techniques still play an important role in this population. In particular, reduction may be suitable for individuals who identify as nonbinary and desire to have the flexibility to present in a feminine manner while gaining the ability to bind their chest and present as masculine with less or no pain.

Numerous studies have described the surgical techniques, aesthetic outcomes, and postoperative complications related to masculinizing mastectomy [3, 11, 12, 14–17, 19–23]. In comparison, the literature on reduction techniques in this population is sparse [24–28]. To our knowledge, there have been no studies comparing postoperative outcomes between the two techniques.

The objective of this study is to present a national epidemiologic analysis and comparison of postoperative complication profiles associated with various techniques employed for transmasculine chest reconstruction using the American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) database.

Methods

Datasets

The ACS NSQIP database from 2010 to 2017 was used for this retrospective analysis, and methods of data collection have been previously described [29]. Briefly, the ACS NSQIP is a nationally validated, multi-institutional surgical outcomes program that collects data on approximately 240 variables from over 400 institutions nationwide [30]. The data contained in this cohort are deidentified and available to all institutions adhering to the ACS NSQIP data use agreement.

Cohort selection

We utilized International Classification of Diseases, Ninth Revision (ICD-9) and Tenth Revision (ICD-10) codes to identify patients with a primary diagnosis of gender dysphoria and/or related conditions (e.g., transsexualism) at the time of surgery (Table 2). Current procedural terminology (CPT) codes (Table 3) were used to identify and categorize top surgery cases based on reconstructive modality: mastectomy or reduction mammaplasty. We reviewed all concurrent CPT codes and excluded subjects that underwent concurrent procedures unrelated to the breast operation. A subgroup analysis comparing mastectomy techniques with and without documented free nipple grafting was also performed.

Variables

We selected a number of variables from the NSQIP dataset pertaining to patient demographics, comorbidities, perioperative risk factors, and postoperative outcomes. These variables include preoperative health characteristics, past medical and surgical history, American Society of Anesthesiologists (ASA) physical status, and measures of 30-day postoperative morbidity and mortality. A complete list of variables and corresponding definitions can be found on the National Surgical Quality Improvement Program Web site (https://site.acsnsqip.org/).

Statistical Analysis

To assess for unadjusted differences in demographics, baseline health characteristics, comorbid conditions, and postoperative complications between the mastectomy and reduction cohorts, we performed univariate analyses. Continuous variables were evaluated using the two-sided unpaired t test, whereas the Chi-square test was used to compare categorical data. Statistical significance was reported as $p < 0.05$.

Variables with $p < 0.05$ on univariate analysis were entered into a multivariable binary logistic regression, along with surgical technique, using all-cause complications as the dependent variable. From this model, we derived adjusted odds ratio (OR) and its corresponding 95% confidence interval for each independent risk factor. All statistical analyses were performed using IBM SPSS version 24 for Windows (IBM Corp, Armonk, NY).

Results

General

The ACS NSQIP database from 2010 to 2017 contains 5,665,960 entries, of which 788 correspond to transmasculine chest reconstructions (Fig. 1). After exclusion criteria were applied, a total of 755 entries were selected for analysis, 591 (78.3%) mastectomies and 164 (21.7%) reductions. Increasing numbers of mastectomy and reduction cases were noted from 2010 to 2017, with the rate of

Table 2 ICD-9 and ICD-10 codes

Description	ICD-9/ICD-10 code
Transsexualism with unspecified sexual history	302.50
Transsexualism with asexual history	302.51
Transsexualism with homosexual history	302.52
Transsexualism with heterosexual history	302.53
Gender identity disorder in children	302.6
Gender identity disorder in adolescents or adults	302.85
Transsexualism	F64.0
Gender identity disorder in adults	F64.1
Gender identity disorder in children	F64.2
Other gender identity disorders	F64.8
Gender identity disorder, unspecified	F64.9

Table 3 Current procedural terminology codes

Description	CPT code
Mastectomy, partial	19301
Mastectomy, simple, complete	19303
Mastectomy, subcutaneous	19304
Reduction mammaplasty	19318
Free nipple grafting (FNG)	19350

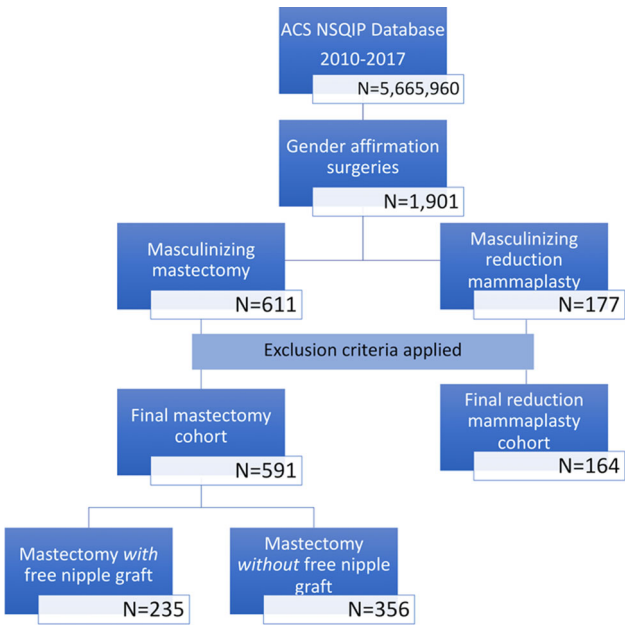

Fig. 1 Data extraction strategy

Table 4 Demographic characteristics

	Mastectomy	Reduction	*P*
No. of patients	591	164	
Mean age ± SD, year	28.6 ± 9.4	28.2 ± 8.1	0.580
Race			**< 0.001**
White	398 (67.3%)	71 (43.3%)	
Black	66 (11.2%)	16 (9.8%)	
Asian	20 (3.4%)	6 (3.7%)	
AI or AN	1 (0.2%)	1 (0.6%)	
NH or PI	0 (0%)	0 (0%)	
Unknown/unreported	106 (17.9%)	70 (42.7%)	
Ethnicity			**< 0.001**
Hispanic	37 (6.3%)	5 (3.0%)	
Non-Hispanic	500 (84.6%)	93 (56.7%)	
Unknown/not reported	54 (9.1%)	66 (40.2%)	
Admission year			**0.015**
2017	254 (43.0%)	75 (45.7%)	
2016	156 (26.7%)	61 (37.2%)	
2015	107 (18.1%)	21 (12.8%)	
2014	46 (7.8%)	2 (1.2%)	
2013	15 (2.5%)	4 (2.4%)	
2012	8 (1.4%)	1 (0.6%)	
2011	1 (0.2%)	0 (0%)	
2010	2 (0.3%)	0 (0%)	
Surgical specialty			**0.002**
Plastic surgery	504 (85.3%)	154 (94.5%)	
General surgery	87 (14.7%)	9 (5.5%)	

AI American Indian, *AN* Alaska Native, *NH* Native Hawaiian, *PI* Pacific Islander

p values are bolded if < 0.05

mastectomy increasing faster (Table 4). Year-to-year increases in case volume are often attributed to increased institutional enrollment in the ACS NSQIP. To control for concerns that increases in case volume could be affected by institutional enrollment [31, 32], we compared annual changes in the proportion of cases corresponding to transmasculine chest reconstruction to the proportion of laparoscopic cholecystectomy cases, which were expected to remain constant (Fig. 2). Between 2012 and 2017, the

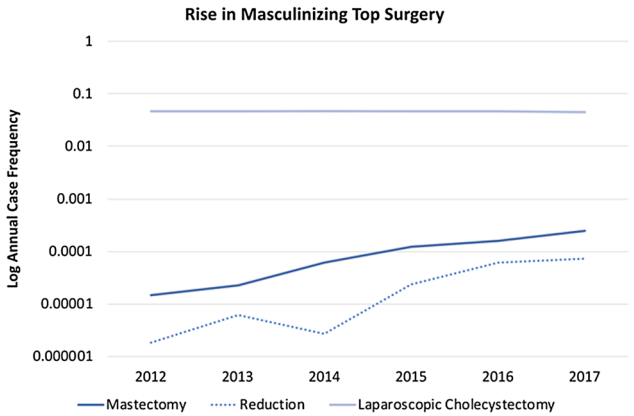

Fig. 2 Logarithmic scale of masculinizing top surgery and laparoscopic cholecystectomy case frequency as reported in the ACS NSQIP database from 2012 to 2017. Laparoscopic cholecystectomy frequency is included as a comparison, as that frequency remained relatively constant over the study period

rate of reporting for transmasculine top surgeries increased by 1.833% ($p < 0.001$).

Patient Demographics and Surgical Specialty

Mean age at time of surgery for the entire study population was 28.5 ± 9.1 years, with no significant difference between cohorts ($p = 0.580$). The average age of patients undergoing transmasculine chest reconstruction significantly decreased during the study period ($p = 0.023$) (Fig. 3). Overall, the majority of patients in the entire study were White (62.1% [$n = 469$]) and non-Hispanic (78.5% [$n = 593$]). Plastic surgeons performed the majority of procedures (87.2% [$n = 658$]).

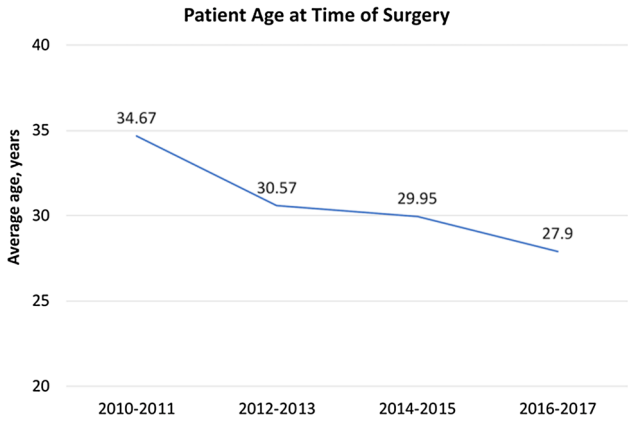

Fig. 3 Average age of patients undergoing transmasculine top surgery from 2010 to 2017

Comorbidities and Operative Characteristics

Mean body mass index (BMI) was similar between the two cohorts (29.6 ± 7.5 kg/m^2 in reductions versus 28.6 ± 7.0 kg/m^2 in mastectomies), but obesity (defined as BMI ≥ 30.0 kg/m^2) [33] was more prevalent in the reduction cohort (43.5% [$n = 70$] versus 34.3% [$n = 199$], $p = 0.031$). Rates of smoking, hypertension, and diabetes in the full study population were 18.9% ($n = 143$), 4.6% ($n = 35$), and 1.9% ($n = 14$), respectively, with no significant differences between the two cohorts (Table 5). Reduction procedures had longer operative times (195.0 ± 58.2 min versus 147.1 ± 54.4 min, $p < 0.001$), but there were no differences in length of stay (0.31 ± 0.62 days for reductions versus 0.230 ± 0.70 days for mastectomies, $p = 0.155$).

Postoperative Complications and Multivariable Regression

The overall rate of all-cause postoperative complications (Table 6) was 4.7% ($n = 28$) for mastectomy and 3.7% ($n = 6$) for reduction ($p = 0.555$). Unplanned reoperation was the most frequent complication encountered in both the mastectomy (3.2% [$n = 19$]) and reduction (3.0% [$n = 5$]) cohorts ($p = 0.915$). Table 7 summarizes reasons for reoperation. Reduction cases were associated with a higher rate of postoperative urinary tract infection (1.2% [$n = 2$] versus 0%, $p = 0.007$). No significant differences were noted for any other postoperative complication variables.

A multivariable binary regression analysis was performed for all-cause complications in order to identify independent risk factors for adverse outcomes. Included in this model were type of operation, BMI, smoking status, surgical specialty, and operative time. In the multivariate model, none of these factors were associated with a significant difference in risk.

Mastectomy Subgroup Analysis: Impact of Free Nipple Grafting

Mastectomy cases were divided into two cohorts based on the presence or absence of recorded free nipple grafting (FNG). Of the 591 mastectomy cases, 39.8% ($n = 235$) underwent FNG and 60.2% ($n = 356$) did not. The two groups were similar in terms of age, BMI, and operative time (Table 8). Plastic surgeons performed the majority of cases with and without FNG (95.3% [$n = 224$] and 78.7% [$n = 280$], respectively). However, general surgeons performed nearly seven times as many cases without FNG ($n = 76$) as they did with FNG ($n = 11$) ($p < 0.001$). Postoperative outcomes were similar between the two groups, with 3.4% ($n = 8$) of cases with FNG and 5.6%

Table 5 Comorbidities and intraoperative characteristics

	Mastectomy	Reduction	*P*
No. of patients	591	164	
Mean BMI ± SD, kg/m^2	28.6 ± 7.0	29.6 ± 7.5	0.112
Nonobese (BMI ≤ 29.9 kg/m^2)	382 (65.7%)	91 (56.5%)	**0.031**
Obese (BMI ≥ 30.0 kg/m^2)	199 (34.3%)	70 (43.5%)	
ASA classification			0.517
ASA Class 1	226 (38.2%)	60 (36.6%)	
ASA Class 2	348 (58.9%)	96 (58.5%)	
ASA Class 3	16 (2.7%)	8 (4.9%)	
ASA Class 4 or 5	1 (0.2%)	0 (0%)	
Location of procedure			0.373
Inpatient	36 (6.1%)	7 (4.3%)	
Outpatient	555 (93.9%)	157 (95.7%)	
Smoking	113 (19.1%)	30 (18.3%)	0.811
Diabetes (type I or type II)	10 (1.7%)	4 (2.4%)	0.530
Hypertension	28 (4.7%)	7 (4.3%)	0.800
Steroid use	4 (0.7%)	1 (0.6%)	0.925
Operative time, min	147.1 ± 54.4	195.0 ± 58.2	**< 0.001**
Length of stay, days	0.230 ± 0.70	0.31 ± 0.62	0.155

BMI body mass index, *ASA* American Society of Anesthesiologists

p values are bolded if < 0.05

Table 6 Postoperative outcomes: transmasculine mastectomy versus reduction

	Mastectomy	Reduction	*P*
No. of patients	591	164	
All-cause complication	28 (4.7%)	6 (3.7%)	0.555
Superficial surgical site infection	10 (1.7%)	0 (0%)	0.094
Deep surgical site infection	0 (0%)	0 (0%)	
Organ/Space SSI	0 (0%)	1 (0.6%)	0.057
Wound dehiscence	0 (0%)	0 (0%)	
Pneumonia	0 (0%)	0 (0%)	
Pulmonary embolism	0 (0%)	0 (0%)	
Deep vein thrombosis	0 (0%)	0 (0%)	
Urinary tract infection	0 (0%)	2 (1.2%)	**0.007**
Bleeding requiring transfusion	1 (0.2%)	0 (0%)	0.598
Sepsis	1 (0.2%)	0 (0%)	0.598
Unplanned reoperation	19 (3.2%)	5 (3.0%)	0.915
Unplanned readmission	9 (1.5%)	3 (1.8%)	0.787

p value is bolded if < 0.05

(n = 20) of cases without FNG experiencing at least one all-cause complication (p = 0.215). There were no differences in any of the postoperative outcome variables between the two cohorts (Table 8).

Discussion

Gender incongruence in transmasculine and nonbinary individuals is frequently associated with psychological comorbidity [34], substance abuse [35], and unfavorable sexual well-being [36]. For many patients, masculinizing chest reconstruction is a critical step toward feeling more comfortable with their appearance. Furthermore, multiple

Table 7 Reason for reoperation

	Mastectomy	Reduction
No. of patients	591	164
Rate of unplanned reoperation	19 (3.2%)	5 (3.0%)
Reasons for reoperation[a]		
Hematoma	9 (1.5%)	4 (2.4%)
Abscess drainage	4 (0.7%)	1 (0.6%)
Bleeding	1 (0.2%)	0 (0%)
Medical complications	0 (0%)	0 (0%)

[a]Reason for reoperation was missing in 26.3% (n = 5) of FtM cases. Reoperation rate for each diagnosis was calculated as a fraction of the cases with available data

studies have reported substantial improvements in psychosocial functioning following top surgery [5–7]. As such, continued investigation into postoperative outcomes, demographic characteristics, and patient preferences is essential in order to maintain high standards of patient-centered care and identifying racial or ethnic disparities.

The current literature is predominately composed of single-institution studies, most of which report on surgical technique and aesthetic outcomes related to masculinizing mastectomy [3, 11, 12, 14–17, 19–23]. Reduction techniques, although performed with slightly different goals, are infrequently reported in the literature [24–28]. To our knowledge, there have been no studies comparing postoperative outcomes between the two techniques. In an effort to fill this gap in the literature, we used the national ACS NSQIP database to compare demographic characteristics and postoperative outcomes for transmasculine patients seeking mastectomy and reduction mammaplasty.

Our study highlights a number of important demographic trends. First, we noted a substantial rise in the number of transmasculine chest reconstructions performed

Table 8 Mastectomy subgroup analysis

	Free nipple graft	No free nipple graft	*P*
No. of patients	235	356	
Demographics			
Mean age ± SD, year	29.4 ± 9.5	28.1 ± 9.3	0.087
BMI, kg/m^2	28.1 ± 6.5	28.9 ± 7.3	0.205
Operative time, min	147.3 ± 53.5	147.0 ± 55.1	0.936
Surgical specialty			**< 0.001**
Plastic surgery	224 (95.3%)	280 (78.7%)	
General surgery	11 (4.7%)	76 (21.3%)	
Postoperative outcomes			
All-cause complication	8 (3.4%)	20 (5.6%)	0.215
Superficial surgical site infection	2 (0.9%)	8 (2.2%)	0.198
Deep surgical site infection	0 (0%)	0 (0%)	
Organ/space SSI	0 (0%)	0 (0%)	
Wound dehiscence	0 (0%)	0 (0%)	
Pneumonia	0 (0%)	0 (0%)	
Pulmonary embolism	0 (0%)	0 (0%)	
Deep vein thrombosis	0 (0%)	0 (0%)	
Urinary tract infection	0 (0%)	0 (0%)	
Bleeding requiring transfusion	0 (0%)	1 (0.3%)	0.416
Sepsis	0 (0%)	1 (0.3%)	0.416
Unplanned readmission	3 (1.3%)	6 (1.7%)	0.624
Unplanned reoperation	7 (3.0%)	12 (3.4%)	0.791
Reason for reoperation[a]			
Hematoma	5 (2.1%)	4 (1.1%)	
Abscess drainage	1 (0.4%)	4 (1.1%)	
Bleeding	0 (0%)	0 (0%)	
Medical complications	0 (0%)	0 (0%)	

[a]Reason for reoperation was missing in 14.3% (n = 1) of cases with free nipple graft and in 33.3% (n = 4) of cases without free nipple graft

p value is bolded if < 0.05

annually, with 72.3% of all cases being performed in the last two years of the study period. These data are consistent with recent procedural statistics from the American Society of Plastic Surgeons, which note a 328% increase in the number of transmasculine procedures between 2015 and 2017 [37, 38]. Additionally, we noted a steady and statistically significant decline in average patient age at time of surgery. Taken together, these findings likely reflect ongoing improvements in social stigma, access to care, and depth of the transgender workforce. In addition, increased awareness of gender dysphoria among younger populations has inspired changes in management strategies that prioritize the need for surgical intervention over chronological age [5].

Another important epidemiologic trend noted in our study is a discrepancy in the racial and ethnic composition of our surgical cohort when compared with population-based data. In 2016, the William's Institute published a report on the race and ethnicity of US adults identifying as transgender, noting that 55% of respondents were White, 16% were Black, 21% were Hispanic or Latino, and 8% were of another race [39]. Comparatively, our demographic analysis noted higher percentages of White subjects (62.1%) with corresponding decreases in Black (10.9%) and Hispanic (5.6%) patients. Inconsistencies in the demographic characteristics of transmasculine surgical patients highlight concerns about racial and ethnic disparities in insurance and healthcare access. Nationally, compared with non-Hispanic White transgender individuals, Black and Hispanic persons are more likely to be uninsured [4] and less likely to seek medical care because of cost or fear of mistreatment [40].

Historical approaches to transmasculine chest reconstruction largely resembled reduction techniques with various modifications. In 1979, Lindsay [25] published the first top surgery case series, describing C- and J-shaped approaches and the Strombeck-like reduction with an inverted T scar in nine patients. Since that time, numerous authors have reported their experience with various reduction-like techniques, including those similar to the Maillard, McKissock, and Wise techniques [24, 26, 28, 41]. More recently, surgeons began to appreciate that subcutaneous mastectomy, compared to reduction mammaplasty, was better able to approximate the male chest contour [11, 16–18]. However, reduction techniques are still employed, particularly for nonbinary individuals who may actually wish to retain some amount of breast tissue. Additionally, surgeons who do not work regularly with the transgender population may offer traditional reduction procedures when masculinizing mastectomy may be more appropriate, due to less familiarity with the technique [42]. This poses a risk of individuals needing to seek a second chest surgery in the future [43–45]. In our study, the distribution of reconstructive approaches mirrors this historical paradigm shift, with mastectomies outnumbering reductions 3.3:1.

Overall, postoperative outcomes were favorable in our study, with 4.7% of mastectomies and 3.7% of reductions experiencing at least one all-cause complication. Rates of acute complications following masculinizing mastectomy in the literature range from 2.1 to 9.2% [12], which is consistent with our data. Postoperative outcomes for masculinizing reduction, in comparison, have not been well documented. In a 1979 case series of nine patients undergoing transmasculine reduction, Lindsay [25] reported a complication rate of 44%. More recent studies of breast reduction in cisgender females report complication rates ranging from 2.0 to 6.2% [46, 47], which are consistent with our findings.

Infection was the most common complication in the mastectomy cohort, occurring in 2.4% of patients. This is consistent with data from numerous retrospective studies, which report rates of infectious complications ranging from 0 to 3.7% [17, 21, 46, 48–51]. Unplanned reoperation for hematoma evacuation was the second most frequent complication following mastectomy, noted in 1.5% of cases in our study. Comparatively, rates of hematoma evacuation as reported in the literature range from 3.4 to 10.0% [16, 19, 21, 48, 52–54]. This discrepancy is possibly explained by the 30-day window within which ACS NSQIP captures postoperative outcomes.

The most frequent complication in our reduction cohort was reoperation secondary to hematoma formation (2.4% of cases). Rates of hematoma formation following cisgender breast reduction have been reported at 1.0–2.0% of cases [46, 47], which is consistent with our findings. Infectious complications were slightly less frequent in our reduction cohort, occurring in 1.2% of patients. This rate is consistent with data from the cisgender population, which notes infectious complications in 1.0–3.8% of cases [46, 47].

Of the 591 mastectomy cases in our study, 39.8% employed the free nipple graft (FNG) technique, whereas 60.2% did not involve FNG. This distribution of techniques is consistent with a recent systematic review of masculinizing mastectomy by Wilson et al. [12], which found that 42.2% cases used FNGs. Demographic characteristics, including age and BMI, were similar between cohorts with and without FNG. Interestingly, our analysis noted that only 10% of mastectomies performed by general surgeons involved a FNG, compared with 45% performed by plastic surgeons. However, it is important to note that insurance coverage for and CPT-based coding of free nipple grafts are inconsistent [55], and therefore, it is possible that some individuals underwent FNG but were not coded appropriately.

The rate of all-cause complications was not statistically different between the two groups, with 3.4% of FNG cases and 5.6% of cases without FNG experiencing all-cause complications. Numerous authors have suggested a trend toward increased complications with skin-sparing (i.e., semicircular or transareolar), as opposed to skin resection (i.e., inframammary incision and FNG), techniques, often attributed to the small window of exposure in the skin-sparing approaches [3, 12, 56]. Our analysis also noted a lower rate of all-cause complications in the FNG group (3.4%) compared to the cohort without FNG (5.6%), although this finding was not statistically significant.

After controlling for differences in demographic characteristics and comorbidities, there was no difference in risk of complications between mastectomy and reduction when performed for gender affirmation. Similarly, we found that techniques involving FNG were not associated with a significantly lower risk of all-cause complications in this cohort. Ultimately, these data support prior recommendations by Monstrey et al. [3] regarding technique selection in transmasculine chest wall contouring: The reconstructive approach should be based on breast characteristics and patient preference.

Notwithstanding the differences in aesthetic goals and outcomes, both mastectomy and reduction have an important role in the transmasculine population, and the results of this study have implications for shared decision making (SDM). As research on surgical technique, complication profiles, and aesthetic and patient-reported outcomes begets advancements in the surgical approaches available for gender affirmation, the importance of SDM in the TG/NB community has never been more apparent [57, 58]. Important future directions for this study include integration of these results into decision aid tools and further investigation into the possible causes for the observed racial and ethnic disparities.

Although the ACS NSQIP allows for a robust evaluation of outcomes on a multi-institutional, nationwide level, there are important limitations to be discussed. Outcomes in this database are limited to a 30-day window and therefore fail to record potential long-term adverse events. Furthermore, the ACS NSQIP does not collect aesthetic or patient-reported outcomes, which are important components of the procedures in our study. The inability to evaluate preoperative medication use, including hormone therapy, is also an important limitation to this study. Finally, as with all studies using large databases, analysis is dependent upon rigorousness of variable definition as well as accuracy of data entry, which may be influenced by variations in reporting practices between and within institutions. Finally, since the number and composition of institutions enrolled in the ACS NSQIP often vary from year to year, trend analyses cannot be extrapolated onto a population level.

Nonetheless, this first nationwide assessment of techniques in transmasculine chest reconstructions revealed important data pertaining to demographic characteristics and postoperative outcomes. The fact that these national data support previously noted racial and ethnic disparities regarding access to surgical care [40] also reinforces the need to address inequities in insurance coverage and other social factors that may limit access to care.

Conclusions

Masculinizing chest reconstruction is an important component of management in many transgender and nonbinary persons. The results of this study suggest that both reduction mammaplasty and masculinizing mastectomy, with or without free nipple grafting, are safe approaches to chest reconstruction. The adjusted risk of complications of any cause was not statistically different between any of the techniques. With the knowledge that these procedures have similar safety profiles, surgeons and patients can work together to choose the technique that best matches the desired outcome. Furthermore, awareness of ongoing access disparities may inspire collaboration between surgeons and patients in order to improve the equity of care delivery and access in this population.

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Compliance with Ethical Standards

Conflict of interest None of the authors have a financial interest in any of the products, devices, drugs, or procedures mentioned in this manuscript.

Ethical Approval The patient information in this study is deidentified and available to all institutions complying with the American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) Data Use Agreement.

Informed Consent For this type of study, informed consent is not required.

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