For centuries, human beings have demonstrated an unwavering interest in external appearance. Although the “ideal” body type has varied significantly across time and place, humans have a long history of working to achieve a physique that brings comfort and confidence. Innovations in medicine and surgery have evolved in parallel with society’s interests. The breast is arguably the best example of this concept, with descriptions of aesthetic modifications dating as far back as 3,000 BC.1–5 Primitive implant materials, including ivory, glass, metal, rubber, paraffin, petroleum jelly, beeswax, shellac, and epoxy resins, gained popularity during the 19th and early 20th centuries, but often left patients disfigured and with serious complications.6–12 Persistence of breast augmentation procedures despite these poor and sometimes fatal outcomes provides context for understanding how breast augmentation in transgender women can be an important first step in addressing gender incongruence and improving psychosocial functioning. The aim of this study was to compare postoperative outcomes of augmentation mammoplasty in transgender and cisgender females.

Methods: We queried the American College of Surgeons National Surgical Quality Improvement Program database from 2006 to 2017 to establish 2 cohorts: (1) transgender females undergoing gender-affirming breast augmentation (“top surgery”) and (2) cisgender females seeking cosmetic breast augmentation (CBA). Demographic characteristics and postoperative outcomes were compared between the 2 cohorts. Multivariable regression analysis was used to control for confounders.

Results: A total of 1,360 cases were identified, of which 280 (21%) were feminizing top surgeries and 1,080 (79%) were CBA cases. The transfeminine cohort was significantly older, had a higher average body mass index, and was more racially diverse than the CBA cohort. Transfeminine patients also had higher rates of smoking, diabetes, and hypertension. The rates of all-cause complications were low in both cohorts, and differences were not significant (1.6% transfeminine versus 1.8% CBA, \( P = 0.890 \)) for the first 30-days after operation. After controlling for confounding variables, transfeminine patients had postoperative complication profiles similar to their cisgender counterparts. Multivariable regression analysis revealed no statistically significant predictors for all-cause complications.

Conclusions: Transfeminine breast augmentation is a safe procedure that has a similar 30-day complication profile to its cisgender counterpart. The results of this study should reassure and encourage surgeons who are considering performing this procedure.

Epidemiologic Characteristics and Postoperative Complications following Augmentation Mammaplasty: Comparison of Transgender and Cisgender Females

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Background: Breast augmentation in transgender women can be an important first step in addressing gender incongruence and improving psychosocial functioning. This study aimed to compare postoperative outcomes of augmentation mammoplasty in transgender and cisgender females.

Methods: The American College of Surgeons National Surgical Quality Improvement Program database was queried from 2006 to 2017 to establish two cohorts: (1) transgender females undergoing gender-affirming breast augmentation (“top surgery”) and (2) cisgender females seeking cosmetic breast augmentation (CBA). Demographic characteristics and postoperative outcomes were compared between the two cohorts. Multivariable regression analysis was used to control for confounders.

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Conclusions: Transfeminine breast augmentation is a safe procedure that has a similar 30-day complication profile to its cisgender counterpart. The results of this study should reassure and encourage surgeons who are considering performing this procedure.

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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; rather are the result of the work done by the authors of this study. The patient information in this study is de-identified and available to all institutions complying with the American College of Surgeons Data Use Agreement.

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essential breasts are to the feminine physique, and therefore to the perception of femininity as a whole.

For many transgender women, lack of breasts contributes significantly to gender incongruence, body dissatisfaction, and psychological comorbidity. Although hormone replacement therapy may result in some degree of breast development, it is typically insufficient to effectively address chest dysphoria, thus necessitating augmentation mammoplasty (top surgery) to better approximate the cisgender female breast. According to the 2015 United States Transgender Survey, 74% of transfeminine individuals either have had, or someday want to have breast augmentation surgery. Benefits of breast augmentation in this population, including improvements in quality of life and psychosocial and sexual well-being, are well documented. Breast augmentation may also be influential in facilitating a patient’s social transition, and social transition is a prerequisite for vaginoplasty.

Despite the seemingly exponential rise in feminizing operations performed annually, the literature on this population is sparse. Prior studies have emphasized technical details, surgical anatomy, and postoperative aesthetic outcomes. Major limitations to the body of existing literature include small sample size, lack of multi-institutional studies, and minimal data pertaining to postoperative complication profiles.

In contrast, cosmetic augmentation in the cisgender population, which has consistently been the most common aesthetic procedure performed in the United States, has been extensively described in the literature. Despite some natal sex differences in chest wall and mammary anatomy between cisgender and transgender females, the technical aspects of the operation are broadly similar. Furthermore, with widespread use of testosterone blockers and estrogen therapy in transfeminine patients, the hormonal environment between these groups is also quite similar.

The objective of this study is to analyze nationally-reported demographic characteristics and postoperative outcomes relating to transfeminine augmentation mammoplasty in comparison to cosmetic augmentation in cisgender females. We used the American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) to conduct this study because of its robust sample size and multi-institutional nature.

**METHODS**

**Datasets**

We conducted a retrospective analysis of the ACS NSQIP database from 2005 to 2017. The ACS NSQIP is a nationally validated, risk-adjusted, surgical outcomes program that collects information on approximately 240 variables from over 400 institutions nationwide. The data contained in this cohort is deidentified and available to all institutions adhering to the ACS NSQIP data use agreement. Methods of data collection have been previously described.

**Table 1. ICD-9 and ICD-10 Codes**

| Description | ICD-9 Code | ICD-10 Code |
|-------------|------------|-------------|
| Transgender cohort | 302.50 | | 302.96 |
| Transsexualism with unspecified sexual history | 302.50 | | 302.96 |
| Transsexualism with asexual history | 302.51 | | 302.96 |
| Transsexualism with homosexual history | 302.52 | | 302.96 |
| Transsexualism with heterosexual history | 302.53 | | 302.96 |
| Gender identity disorder in children | 302.60 | | 302.85 |
| Gender identity disorder in adolescents or adults | 302.85 | | 302.85 |
| Transsexualism | F64.0 | | 302.85 |
| Gender identity disorder in adults | F64.1 | | 302.85 |
| Gender identity disorder in children | F64.2 | | 302.85 |
| Other gender identity disorders | F64.8 | | 302.85 |
| Gender identity disorder, unspecified | F64.9 | | 302.85 |

**Transgender Cohort Selection**

International Classification of Diseases, Ninth Revision (ICD-9) and corresponding Tenth Revision (ICD-10) codes were used to identify patients with a primary diagnosis of gender dysphoria at the time of surgery (Table 1). We then used Current Procedural Terminology codes (19325) to identify patients undergoing augmentation mammoplasty with prosthetic implants and excluded subjects that also underwent concurrent operations unrelated to the breast procedure.

**Cisgender Cohort Selection**

Patients undergoing cosmetic surgery were identified using ICD-9 and ICD-10 codes (Table 1). Within this cohort, we identified patients undergoing augmentation mammoplasty using Current Procedural Terminology codes (19325). Again, we elected to exclude from analysis any cases with concurrent procedures unrelated to the augmentation.

**Variables**

Demographics such as age and race were collected along with clinical features, baseline health characteristics, past medical and surgical history, and American Society of Anesthesiologists physical status. Postoperative outcomes pertaining to morbidity and mortality were also collected and analyzed. A complete list of variables and corresponding definitions can be found on the National Surgical Quality Improvement Program website (http://site.acsnsqip.org/).

**Statistical Analysis**

To assess the difference in means of continuous variables, the 2-sided unpaired t-test was used, whereas the Chi-square or Fisher’s exact tests (where cell numbers were less than 5) were used to analyze categorical data. Univariate analysis was performed to evaluate for unadjusted differences in demographics, comorbidities, perioperative risk factors, and postoperative complications between the transgender and cisgender cohorts.

Statistical significance was reported as $P < 0.05$. Preidentified variables of interest as well as those with
unadjusted $P < 0.05$ on univariate analysis were included in a multivariable binary logistic regression with all-cause complications as the dependent variable. Adjusted odds ratio and its corresponding 95% confidence interval were derived for each independent risk factor. All statistical analyses were performed using IBM SPSS version 24 for Windows (IBM Corp, Armonk, NY).

**RESULTS**

**General**

The 2005–2017 NSQIP databases were used to identify 2,547 augmentation cases out of 6.6 million total procedures (Fig. 1). Predetermined exclusion criteria were then applied, which removed 1,187 entries. The final study population consisted of 1,360 cases, of which 280 (21%) were feminizing top surgeries and 1,080 (79%) were cosmetic breast augmentations (CBAs). Increasing numbers of transfeminine top surgeries were noted each year (Table 2). This trend is apparent for numerous procedures recorded in the NSQIP and is often attributed to increased institutional enrollment. To accurately assess trends in feminizing top surgeries while controlling for changes in enrollment; we compared the rate of reporting for transfeminine cases to that of laparoscopic cholecystectomy (Fig. 2). From 2012 to 2017, the proportion of cases in the NSQIP that involved laparoscopic cholecystectomy consistently ranged between 4.5% and 4.7%. In 2012, transfeminine top surgeries accounted for only 18 in 100,000 NSQIP cases. In 2017, that number rose to 11.7 in 1,000, which represents a 62-fold increase ($P < 0.001$).

**Patient Demographics and Surgical Specialty**

The mean age of the transfeminine cohort was older (36.8 ± 12.9 years versus 34.8 ± 10.6, $P = 0.02$) than the CBA cohort, and this was statistically significant. However, between 2012 and 2017, the average age of patients undergoing feminizing top surgery steadily decreased (Fig. 3). Plastic surgeons performed the majority of transfeminine [97.5% (n = 273)] and CBA [99.4% (n = 1,073)] cases, but the transfeminine cohort had more than 4 times the proportion of cases performed by general surgeons (2.5% versus 0.6%, $P < 0.001$) (Table 2). Before exclusion of select cases, all concomitant operations were reviewed and categorized, as shown in Table 3.

**Comorbidities and Intraoperative Characteristics**

The transfeminine cohort had a higher average body mass index (BMI) (26.7 ± 5.6 kg/m² versus 22.3 ± 3.4 kg/m², $P < 0.001$) and a higher proportion of patients with ASA class 3 or greater [6.8% (n = 19) versus 1.3% (n = 14), $P < 0.001$] compared to the CBA cohort Table 4. Additionally, the transfeminine cohort had higher rates of smoking [27.1% (n = 76) versus 10.9% (n = 118), $P = 0.001$], diabetes [4.3% (n = 12) versus 0.9% (n = 10), $P < 0.001$],
and hypertension [10.4% (n = 29) versus 3.1% (n = 34), \( P < 0.001 \)], compared with the CBA cohort. Operative time was significantly longer in the transfeminine cohort (95.9 ± 69.1 minutes versus 75.5 ± 49.6 minutes, \( P < 0.001 \)).

**Postoperative Complications and Multivariable Regression**

The rate of all-cause complications (Table 5) was 1.8% (n = 5) in the transfeminine cohort and 1.6% (n = 18) in the CBA cohort (\( P = 0.890 \)). No significant differences were noted for any of the postoperative complication variables. Given the low number of outcomes of interest, only 3 preoperative factors were included in the multivariable regression analysis for all-cause complications: smoking status, BMI, and transfeminine procedure. The regression

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**Table 3. Summary of Gender Affirmation Operations**

| Procedure                  | No. of Procedures |
|----------------------------|-------------------|
| Total                      | 335 (in 302 patients) |
| Breast augmentation        | 302               |
| Genital reconstruction*    | 20                |
| Vaginoplasty/clitoroplasty | 14                |
| Penectomy/orchiectomy      | 9                 |
| Facial feminization*       | 13                |
| Rhinoplasty                | 4                 |
| Tracheal shaving           | 3                 |
| Malar augmentation         | 2                 |
| Blepharoplasty             | 1                 |
| Genioplasty                | 1                 |
| Orbital reduction          | 1                 |
| Forehead reduction         | 1                 |

*These cases were excluded from statistical analysis due to the potential for confounding of complications.
analysis did not identify any of these as statistically significant predictors for all-cause complications (Table 7). Rates of readmission were higher in the trans-feminine cohort [1.4% (n = 4)] compared to the CBA cohort [0.5% (n = 5)], but the sample size was underpowered to detect a significant difference at such a low frequency of readmission (Tables 6).

**DISCUSSION**

For centuries, breasts have been viewed as a powerful representation of femininity, often emphasized throughout literature, fashion, art, and medicine.\(^1\) Importantly, the relationship between breasts and the female construct exists regardless of one’s natal sex. For transgender females yet to undergo surgical transition, the absence of breasts is often associated with negative body image, dissatisfaction with physical appearance, and lower quality of life.\(^13,15,16\) Furthermore, prior studies have shown that transgender females have disproportionately higher rates of body dissatisfaction and psychological comorbidities, including anxiety and depression, compared with transgender males.\(^13,44\)

For some transgender women, breast augmentation is an effective way to increase their bodily satisfaction and ability to move safely through the world.\(^15,16\) Standards of care relating to breast augmentation, as described by the World Professional Association for Transgender Health, recommend 1 year of hormonal therapy before surgery. This provides a chance for women to maximize their breast growth, but also contributes to the already large fiscal burden in this population.\(^19,45,46\) Although recent legislative changes have enabled wider access to care,\(^14\) many patients still report difficulty with insurance coverage.

Breast augmentation in transgender women has been shown to improve quality of life and psychosocial and sexual well-being.\(^15,16\) Given the unique challenges facing these individuals and the well-documented improvements following chest surgery, persistent communication of demographic data and postoperative outcomes is essential to facilitating informed decision making, maintaining high standards of care, and establishing appropriate regulations regarding coverage of surgical intervention. To address this aim, we employed the ACS NSQIP database.
to evaluate the nationally reported epidemiologic characteristics and postoperative complication profiles of breast augmentations performed for transfeminine transition in comparison to cosmetic augmentation in cisgender females.

Our study noted a sharp increase in the number of transfeminine augmentations performed between 2012 and 2017 (Fig. 2). This finding is consistent with the American Society of Plastic Surgeons procedural statistics reports, which noted a 79.9% increase in the number of transfeminine operations performed between 2015 and 2017.20,21 In contrast, the frequency of cosmetic augmentations remained consistent throughout this period. We also noted a diverse spectrum of concomitant gender affirmation procedures in transfeminine patients undergoing augmentation, including genital reconstruction and facial feminization, although these were excluded from analysis to limit confounding.

Patients in the transfeminine cohort were older than those in the cosmetic augmentation cohort (37 years versus 35 years), which is consistent with prior studies from both populations.24,25,34,36,52 However, our analysis noted a consistent decrease in transfeminine patient age from 2012 to 2017 (Fig. 3), likely a result of improvements in policies and environments, given the World Professional Association for Transgender Health recommendation for hormone therapy before augmentation.16 As such, juxtaposition of these cohorts provides for an informative evaluation of postoperative outcomes.

Overall, our analysis noted favorable postoperative outcomes following transfeminine augmentation, with an all-cause complication rate of 1.8%. In 2018, Fakin et al.25 published their 20-year experience with transfeminine augmentation in 138 patients with rates of all-cause complication and hematoma formation reported at 1.4% and 0.7%, respectively. Reoperation secondary to hematoma formation was also the most common complication in the transfeminine cohort of our analysis, occurring in 1.1% of patients. Hematoma, albeit rare overall, has been identified by multiple authors as one of the primary complications after transfeminine augmentation.18,27 There was also a trend towards a higher (1.4% versus 0.5%) readmission rate in the transfeminine patients, although the study was underpowered to determine if this was a true difference given the extremely low rates of readmission in both groups.

Postoperative complications were similarly infrequent following cisgender augmentation in our study, occurring in 1.6% of patients. Rates of complications as reported in the literature are highly variable, ranging from 1% to 38%, depending on the definition.34,36–40 Similar to our transfeminine cohort, the most common complication in the cisgender group was reoperation secondary to hematoma formation, occurring in 0.8% of patients. This finding is consistent with retrospective studies from Handel58 and Araco,59 that reported hematoma formation in 1%–2% of patients.

Infection has been frequently reported as an important complication following augmentation, with rates as high as 2.5%,5,33,35,50 However, only 1 (0.4%) patient in our transfeminine cohort and 4 patients (0.4%) in the
The cisgender cohort experienced an infectious complication. One possible explanation for this discrepancy is that postoperative outcomes are only collected for 30 days after the time of surgery, something that substantially limits our study. Investigation of postoperative infections by other authors suggests that more than 33% of infections in augmentation patients may not occur until months or even years after surgery. 3,40,64

Overall, our study noted equivalent risk-adjusted 30-day postoperative complication profiles of breast augmentation in the transgender and cisgender populations. These findings have a number of important implications. For one, despite the many barriers facing the transgender population, these individuals are largely receiving quality care, with outcomes comparable to their cisgender counterparts. As such, these results may be encouraging to surgeons who are considering this procedure as part of their practice. Although the workforce of providers who specialize in transgender health has significantly expanded in the past decade, many patients still face incredibly, and sometimes prohibitively, long wait times for certain procedures. Thus, for procedures such as breast augmentation, wherein additional training in transgender surgery is not necessary, it would be useful for transgender patients to be able to access a broader range of surgeons.

Although the nature of our dataset precludes an assessment of secondary aesthetic revisions or long-term complications, such as cancer risk and screening, these topics should be noted. Fakin et al. 25 and Kanhai et al. 26 noted that secondary aesthetic revisions following transfeminine augmentation were performed in 16.7% and 15.9% of patients, respectively. Regarding incidence of breast adenocarcinoma in the transfeminine population, Brown and Jones 20 and Gooren et al. 51 found no difference when compared with age-standardized samples of natal males. Despite reports of breast implant-associated anaplastic large cell lymphoma, 44,65 there does not seem to be any increased risk in the transgender population. However, similar to natal females, continued mammographic and clinical screening for breast cancer is recommended in the transfeminine population. 66 Fortunately, many transgender women have been noted to be receptive to screening, viewing it as an opportunity to further embrace their femininity. 20,67

In addition to the lack of aesthetic and long-term outcomes, our study has a number of important limitations. As with all studies using large databases, such as the ACS NSQIP, case selection is governed by diagnosis and procedural coding, and therefore comparisons of patients or operations are limited by the granularity of the specific codes. In our study, this precludes an analysis of specific incisions or implant size, shape, and location. Further, the ACS NSQIP does not capture patient-reported outcomes, which are especially important in procedures such as this. Additionally, data entry in the ACS NSQIP is susceptible to human error as well as variability in reporting practices amongst and within institutions. Finally, there are limitations associated with institutional enrollment in the ACS NSQIP. First, many augmentation procedures are performed in ambulatory facilities, and thus are not captured by the ACS NSQIP. Second, institutional bias against transgender health may further contribute to smaller sample sizes. In addition, it should be noted that the number and composition of hospitals enrolled in the ACS NSQIP often changes from year-to-year and may be subject to sampling bias. In the absence of statistical weighting of the dataset, trend analyses should not be extrapolated onto a population level.

Despite these limitations, our study provides important information on nationally-reported demographic characteristics and postoperative outcomes following augmentation in transgender and cisgender females. Further investigation is needed to evaluate these trends on a long-term scale and also to correlate these findings with data pertaining to aesthetic and patient-reported outcomes.

CONCLUSIONS

Breasts are intimately associated with feminine identity, and augmentation in transgender women can substantially improve subjective feelings of femininity. Our study illustrates that augmentation is a safe procedure, with a favorable 30-day postoperative complication profile. Notwithstanding natal sex differences, transgender females did not seem to be at an increased risk of short-term complications when compared with their cisgender counterparts. Overall, these results should be encouraging to patients who are considering this procedure and also to surgeons who are considering joining the transgender workforce.

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