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Technical Considerations for Double-Incision Chest Masculinization Surgery With Free Nipple Grafting: A Single-Surgeon Experience

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Abstract

Introduction

Chest masculinization surgery (CMS) is a commonly performed gender-affirming procedure for transgender and gender-diverse (TGD) individuals. Double-incision mastectomy with free nipple grafting remains one of the most widely utilized techniques, although complication rates and aesthetic outcomes remain variable. Few studies describe standardized operative refinements aimed at minimizing surgical and aesthetic complications within this approach.

Methods

We performed a retrospective cohort study of 61 patients who underwent double-incision mastectomy with free nipple grafting by a single surgeon between November 2022 and January 2025. Operative techniques and postoperative surgical and aesthetic outcomes were evaluated. Operative considerations included standardized preoperative markings, tumescent dissection, electrocautery hemostasis, drain placement, compression therapy, multilayered closure, and nipple-areolar complex (NAC) reconstruction techniques.

Results

Postoperative hematoma occurred in three patients (4.9%), seroma in one patient (1.6%), and wound dehiscence requiring intervention in five patients (8.2%). No patients experienced venous thromboembolism (VTE), pulmonary embolism (PE), sepsis, or blood transfusion. Postoperative aesthetic concerns occurred in 20 patients (32.8%), most commonly dog-ear deformity and scar widening.

Conclusion

This study describes a standardized operative framework for double-incision CMS with free nipple grafting and reports associated surgical and aesthetic outcomes in a single-surgeon cohort. These operative considerations may improve reproducibility and help optimize surgical and aesthetic outcomes in gender-affirming chest surgery.

Categories: Plastic Surgery
Keywords: chest masculinization surgery, double-incision mastectomy, free nipple grafting, gender-affirming surgery, gender-affirming top surgery, surgical technique

Introduction

The number of transgender and gender-diverse (TGD) individuals undergoing gender-affirming top surgery has increased significantly in recent years. A cohort study analyzing data from 2016 to 2019 found that gender-affirming surgeries nearly tripled during this period, with breast and chest procedures representing the most commonly performed operations [1].

Gender-affirming top surgery, or chest masculinization surgery (CMS), is a gender-affirming procedure that involves removal and reshaping of breast and chest soft tissues to create a chest contour aligned with the patient's gender-related goals. CMS can be performed using several techniques, including double-incision, periareolar, and keyhole mastectomy, each associated with different complication profiles and aesthetic considerations. Among these approaches, double-incision mastectomy with free nipple grafting remains one of the most utilized techniques, particularly in patients with larger chest size or significant ptosis. A systematic review and meta-analysis by Zhu et al. found that double-incision mastectomy with free nipple grafting was associated with lower complication rates compared with pedicled nipple or periareolar techniques in transmasculine patients [2].

Despite the expanding literature on gender-affirming top surgery, few studies describe intraoperative refinements within the double-incision mastectomy approach aimed at minimizing complications and optimizing contour and aesthetic outcomes. Existing studies primarily compare outcomes across techniques, while operative modifications such as incision design, tumescent dissection, drain management, and closure strategies are often discussed independently rather than as part of a standardized operative framework [3-5].

In this study, we describe a standardized operative approach for double-incision mastectomy with free nipple grafting and report associated surgical and aesthetic outcomes from a single-surgeon series. Operative goals include chest flattening, reduction of excess skin and lateral fullness, and nipple-areolar complex (NAC) resizing and repositioning, individualized to patient anatomy and preferences. We also contextualize these technical considerations within the existing literature to provide an operative framework for optimizing gender-affirming top surgery.

Materials And Methods

Study design and patient selection

We performed a retrospective cohort study of TGD individuals who underwent gender-affirming CMS using double-incision mastectomy with free nipple grafting by a single surgeon (FL) at the Johns Hopkins Hospital in Baltimore, Maryland, between November 2022 and January 2025. Patients undergoing alternative chest masculinization techniques or mastectomy for oncologic or prophylactic indications were excluded. The study included all eligible consecutive patients undergoing double-incision mastectomy with free nipple grafting during the study period. Consecutive patient inclusion and use of a standardized operative approach were intended to reduce selection- and technique-related bias.

Double-incision mastectomy with free nipple grafting was generally selected for patients with larger chest size, excess breast skin envelope, significant ptosis, or those desiring maximal chest flattening. Alternative techniques, including periareolar, keyhole, buttonhole, inferior pedicle, and single-incision approaches, were considered in patients with smaller chest size, minimal skin excess, favorable nipple position, or goals emphasizing preservation of nipple sensation. Technique selection was individualized based on patient anatomy and postoperative goals. Representative outcomes following alternative chest masculinization techniques are shown in Figure *1*. Study reporting adhered to the STROBE guidelines for cohort studies.



FIGURE 1: Representative preoperative and postoperative outcomes following alternative chest masculinization techniques: (a) periareolar/keyhole; (b) buttonhole/inferior pedicle; and (c) single-incision approaches.

These images illustrate alternative approaches for context; the patients shown were not included in the analyzed double-incision mastectomy with free nipple grafting cohort. Within each image set, the preoperative photograph is shown on the left, and the postoperative photograph is shown on the right. Potentially identifying features were digitally removed or obscured to protect patient privacy; no clinically relevant anatomy was altered.

Data collected

Collected variables included patient demographics (age, preoperative BMI, and race/ethnicity), psychiatric and medical comorbidities, hormone therapy use, smoking status, and preoperative breast characteristics

(ptosis and striae). Ptosis was classified according to the Regnault system [6] based on nipple position relative to the inframammary fold (IMF) and inferior breast contour: Grade 1, nipple at the level of the IMF but above the inferior breast contour; Grade 2, nipple below the IMF but above the inferior breast contour; and Grade 3, nipple below the IMF at the lowest point of the breast contour. Collected medical variables included diabetes and hematologic conditions (anemia, thrombocytopenia, erythrocytosis, polycythemia, thrombocytosis, sickle cell trait, history of deep vein thrombosis, von Willebrand disease, and Factor V Leiden). Postoperative surgical and aesthetic outcomes were also recorded.

Outcomes

The primary outcome was postoperative surgical complications, including surgical-site infection, hematoma, seroma, wound dehiscence requiring intervention, skin necrosis, nipple graft loss, venous thromboembolism (VTE), pulmonary embolism (PE), blood transfusion, acute kidney injury (AKI), urinary tract infection (UTI), pneumonia, and sepsis. Postoperative infection was defined as a suspected or confirmed surgical-site infection documented by the treating clinician that prompted oral or intravenous antibiotic treatment and/or procedural or operative intervention.

The secondary outcome was adverse aesthetic outcomes, including scar widening, hypertrophic scarring, dog-ear deformity, and revision procedures performed to address these complications. Adverse aesthetic outcomes were assessed by the senior surgeon during postoperative follow-up and therefore represent surgeon-assessed aesthetic outcomes rather than patient-reported satisfaction. Revision procedures were patient-initiated and reflected aesthetic concerns identified by the patient that warranted intervention (e.g., Kenalog injection) or surgical correction.

Statistical analysis

Descriptive statistics were used to summarize demographic, preoperative, and postoperative variables. Continuous variables are reported as mean and standard deviation (mean ± SD), while categorical variables are reported as count and percentage (n (%)). No missing data were present for variables included in the analysis.

Ethics and institutional review board approval

This study was approved by the Johns Hopkins University Institutional Review Board (approval no. IRB00368337).

Operative techniques

Preoperative Planning and Marking

Preoperative markings were performed with the patient upright and arms relaxed. The vertical midline was marked from the sternal notch to the umbilicus, and breast or chest meridians were drawn to assess symmetry and guide NAC positioning (Figure *2*). For patients with chest wall asymmetries, the chest meridians were used rather than the breast meridians. The IMF was identified bilaterally, and incision markings were modified to create a straighter inferior chest contour aligned with the lower border of the pectoralis major (Figure *3a*). IMF asymmetry was addressed during marking.

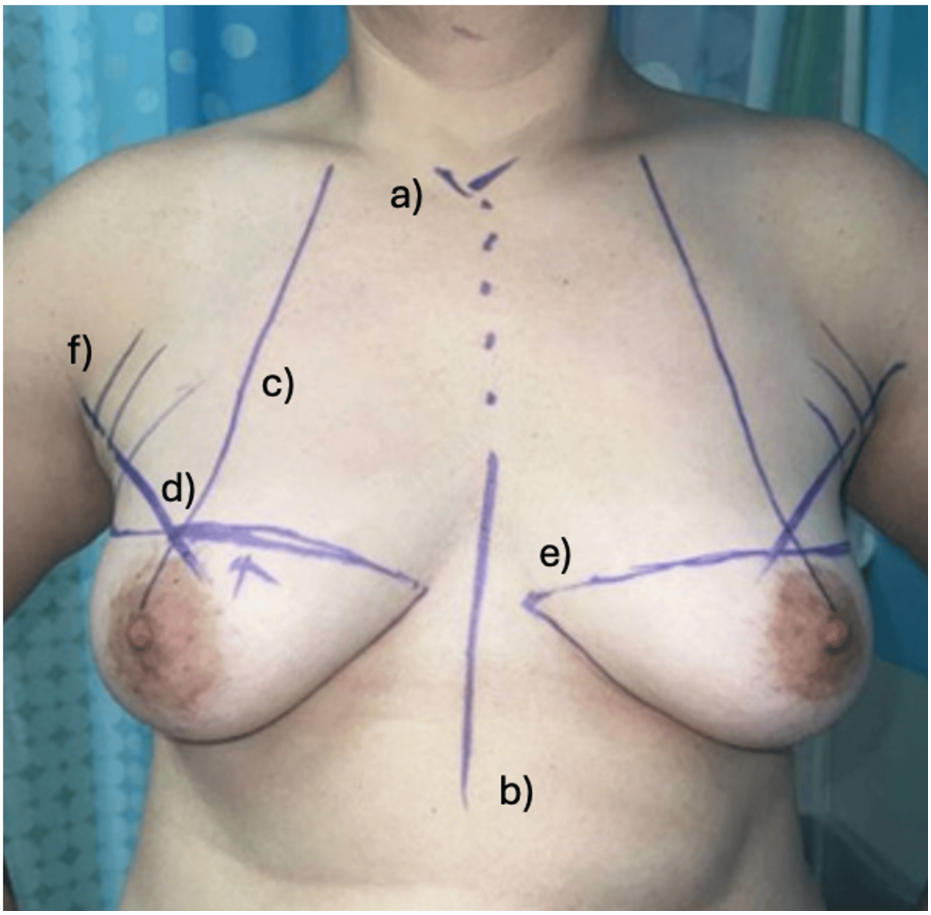


FIGURE 2: Preoperative markings demonstrating (a) the sternal notch, (b) the vertical midline, (c) breast or chest meridians, (d) Pitanguy's point, (e) the superior incision line, and (f) the lateral pectoralis major border.

Hash marks indicate areas designated for skin undermining and fat excision; solid lines delineate planned skin incisions.

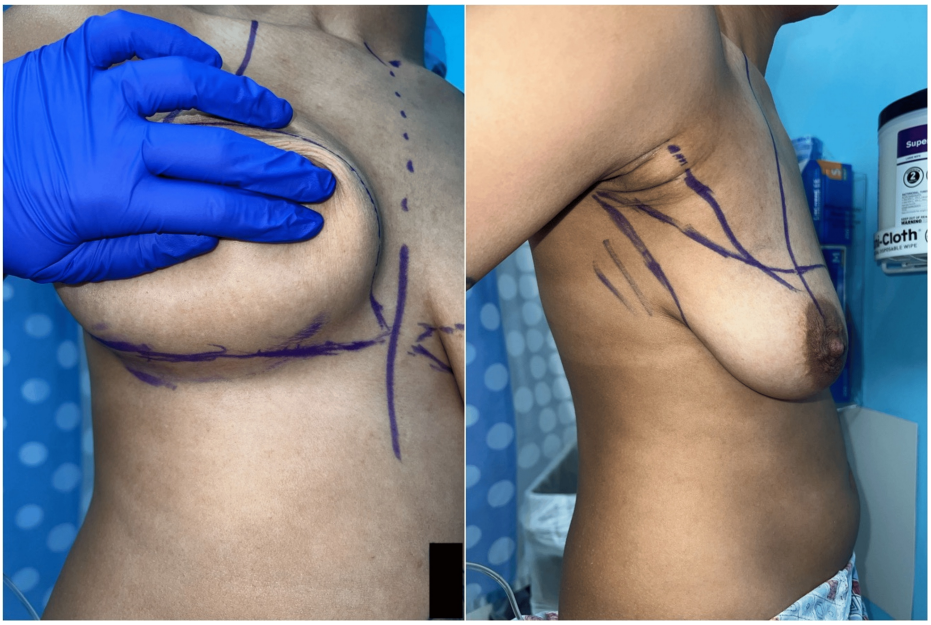


FIGURE 3: (a) Preoperative markings demonstrating modification of the inframammary fold (IMF), with the incision positioned slightly above the IMF centrally and below it medially and laterally. (b) Lateral extension of markings to incorporate the tail of Spence and redundant axillary tissue.

The lateral border of the pectoralis major is outlined with pectoralis flexion and delineated by the superior marking above the tail of Spence. Potentially identifying features were digitally removed or obscured to protect patient privacy; no clinically relevant anatomy was altered.

In patients with ptotic breasts, Pitanguy's point was transposed using the finger method to guide superior incision placement (Figure *2*). The superior incision was generally positioned approximately 2 cm above Pitanguy's point, with the inferior incision placed at the level of the IMF to facilitate tension-free closure and contour optimization. In patients with large, non-ptotic breasts, markings accounted for postoperative chest flattening by preserving excess tissue intraoperatively for final contour refinement.

Medially, the superior and inferior incision lines were either kept separate or joined depending on chest width and breast spacing. Laterally, the incision was extended to include the tail of Spence and redundant axillary and superolateral chest wall tissue. The superior and inferior lateral markings were connected to facilitate complete resection of lateral fullness (Figure *3b*), and areas planned for undermining or fat excision were designated using hash marks (Figure *2*). Failure to remove this tissue can produce an abrupt transition between the chest and lateral contour, resulting in residual fullness that compromises the masculine contour. Patients with significant posterior tissue migration were counseled that standing cone deformities may persist and require secondary revision for optimal contour. The lateral border of the pectoralis major was then outlined with pectoralis flexion to assist with intraoperative contouring and NAC positioning.

Mastectomy, Hemostasis and Fluid Management

Tumescent solution (200-400 cc) containing lidocaine, epinephrine, and sodium bicarbonate was infiltrated into the prepectoral plane bilaterally through lateral stab incisions later used for drain placement. Intravenous tranexamic acid (TXA) was administered at the start of the procedure. The superior and inferior incision markings were infiltrated with 1% lidocaine and epinephrine in the subdermal plane.

Incisions were made sharply along the preoperative markings, and mastectomy flaps were elevated using electrocautery at 50 ESU while preserving the pectoralis fascia. Dissection proceeded superiorly along the breast capsule to the level of the pectoralis fascia. Inferior traction was applied to the breast mound with a Kocher clamp while the skin flap was elevated with the nondominant hand (Figure *4*). This maneuver helps expose the natural plane between subcutaneous fat and the breast capsule and facilitates efficient flap elevation in challenging cases, such as patients with severely ptotic or atrophic breasts. Contour symmetry was assessed throughout the procedure in both supine and upright positions to maintain adequate flap thickness.

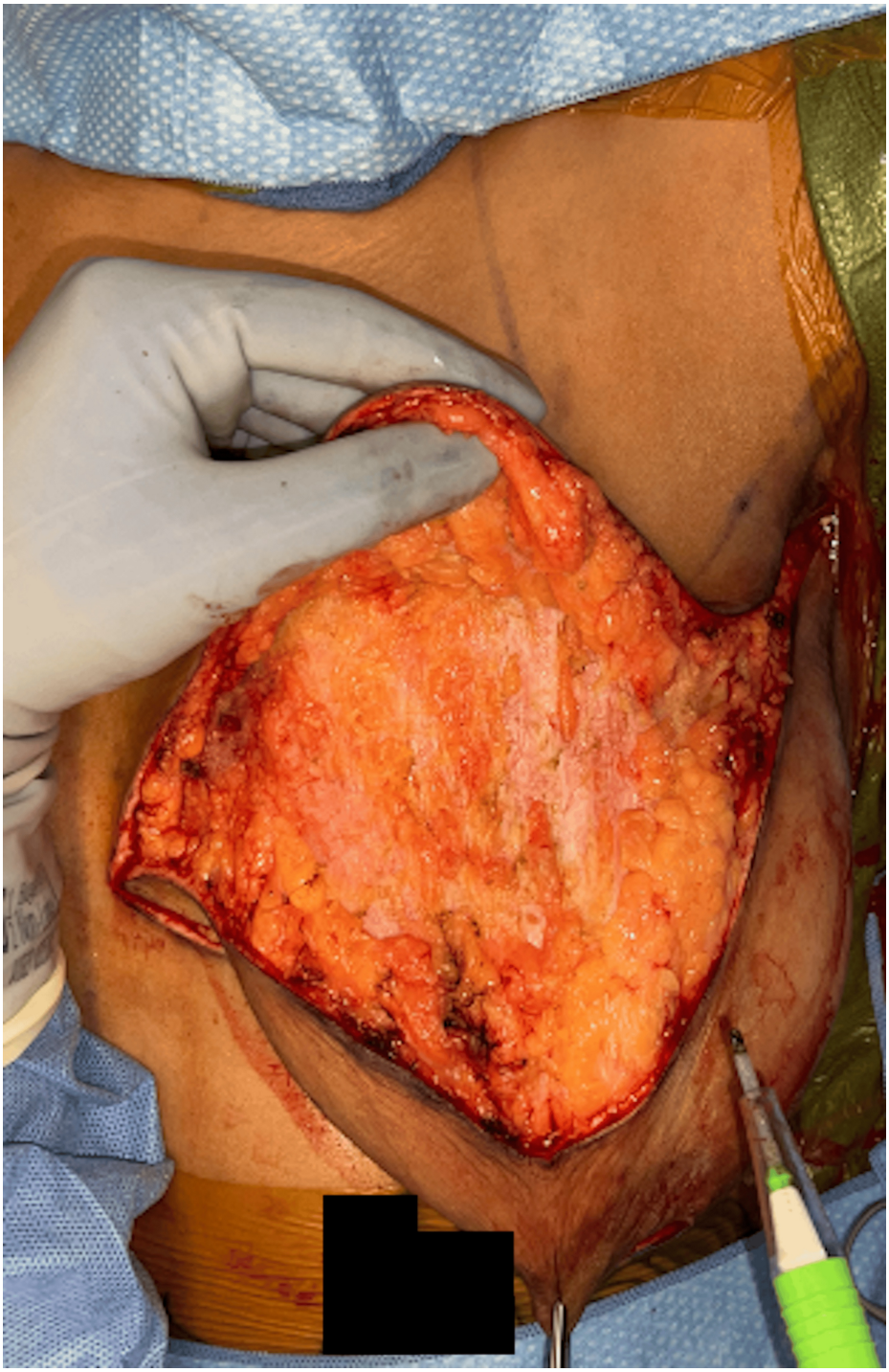


FIGURE 4: Inferior traction is applied to the breast mound with a Kocher clamp while the skin flap is elevated to facilitate identification of the dissection plane between the breast capsule and subcutaneous tissue.

Potentially identifying features were digitally removed or obscured to protect patient privacy; no clinically relevant anatomy was altered.

Medially, subcutaneous tissue overlying the sternum was selectively excised when necessary to improve contour. In higher BMI patients, some required connection of the right and left mastectomy incisions to remove redundant central tissue. Laterally, dissection was continued along the tail of Spence while avoiding deep dissection into the axilla to preserve critical neurovascular structures and lymph nodes. Inferior undermining below the IMF was performed to remove residual parenchymal and adipose tissue and improve lower chest contour, including complete excision of the IMF structure.

Bilateral 19-French Jackson-Pratt drains were placed through lateral stab incisions to assist with postoperative fluid management. Prior to closure, a Valsalva maneuver was performed to identify and control residual bleeding. Particular attention was paid to the axillary, lateral intercostal, and medial perforator zones during final hemostatic assessment. Patients were instructed to wear compression vests continuously for three weeks postoperatively.

Closure and Postoperative Management

A multilayered closure was performed using interrupted 2-0 Vicryl sutures to approximate the superficial fascial system, followed by a 3-0 barbed dermal closure. The external tubing of the Jackson-Pratt drains was padded to minimize pressure-related skin injury, and the drains were removed once output was less than 30 mL over two consecutive days.

The chest incisions were dressed with adhesive wound closure strips (Steri-Strips; 3M, St. Paul, MN, USA) or silk fibroin wound closure strips (SYLKE; Sylke, Inc., La Jolla, CA, USA), non-adherent dressings (Telfa; Solventum/3M Health Care, St. Paul, MN, USA), and transparent film dressing (Tegaderm; 3M, St. Paul, MN, USA), followed by abdominal pads and a compression vest. Silicone-based scar therapy was recommended for up to one year postoperatively following initial wound healing, and intralesional steroid injections were offered for hypertrophic scarring when indicated.

NAC Reconstruction

The NAC was harvested as a full-thickness graft using a 22-mm dermatologic punch, with graft size modified based on patient anatomy when appropriate. Grafts were thinned by wrapping the graft over the index finger or by applying four mosquitoes at cardinal points along the graft. A small dermal-fat pad beneath the nipple was preserved to maintain projection. Patients were counseled preoperatively regarding the potential for reduced nipple sensation or NAC loss associated with free nipple grafting.

Following mastectomy closure, the patient was positioned upright for NAC site marking. The NAC was typically positioned slightly lateral to the chest meridian and approximately 1.5-2 cm above the mastectomy incision. A 22-mm NAC sizer was used to define the width of the NAC, while the height was intentionally shortened to create a more elliptical, masculine NAC shape. Alternatively, the back of a 10-cc syringe can be used to mark the recipient site by coloring the plunger end with a surgical marking pen and stamping the desired NAC location. Recipient sites were de-epithelialized while avoiding cauterization of recipient site vessels to preserve graft perfusion. Grafts were secured using running 5-0 Monocryl sutures in a half-buried subcuticular fashion, with additional 5-0 fast-absorbing gut tacking sutures placed at the cardinal positions to maintain shape and projection (Figure *5*).



FIGURE 5: Intraoperative close-up view of the reconstructed nipple-areolar complex (NAC) following graft inset.

Cardinal tacking sutures are placed at the 12, 3, 6, and 9 o'clock positions to maintain graft shape and projection before bolster dressing application. Running half-buried subcuticular 5-0 Monocryl sutures are used to complete the inset.

Bolster dressings consisting of petrolatum gauze (Xeroform; Cardinal Health, Dublin, OH, USA) folded into a 2.5 × 2.5 cm bolster, two eye pads, and transparent film dressing (Tegaderm; 3M, St. Paul, MN, USA) were applied over the NAC grafts.

Results

Cohort demographics

A total of 61 patients underwent CMS with double-incision mastectomy and free nipple grafting between November 2022 and January 2025 using the operative approach described.

The mean age was 27.9 ± 8.1 years, and the mean BMI was 32.7 ± 7.6 kg/m^2. The cohort was predominantly non-Hispanic White (n = 41, 67.2%), followed by non-Hispanic Black (n = 16, 26.2%) and other racial or ethnic identities (n = 4, 6.6%). Mean follow-up duration was 145.6 ± 101.4 days (Table *1*).

Characteristic	Value
Demographics	
Age, years	27.93 ± 8.06
BMI, kg/m^2	32.74 ± 7.56
Follow-up, months	4.8 ± 3.3
Race/ethnicity	
Non-Hispanic White	41 (67%)
Non-Hispanic Black	16 (26%)
Other	4 (6.6%)
Medical and psychiatric history	
Any psychiatric comorbidity	52 (85%)
Any medical comorbidity	44 (72%)
Hypertension	5 (8.20%)
Diabetes mellitus	3 (4.9%)
History of immunosuppressive drug use*	3 (4.9%)
Hematologic condition**	9 (15%)
Anticoagulant use	1 (1.6%)
Connective tissue disorder	2 (3.3%)
History of tobacco, marijuana, or vape use	34 (56%)
Prior gender-affirming surgery	6 (9.8%)
Age at hormone therapy initiation, years	24.78 ± 8.59
Breast-specific characteristics	
Preoperative chest striae	28 (46%)
No ptosis***	11 (18%)
Grade 1 ptosis***	6 (9.8%)
Grade 2 ptosis***	23 (38%)
Grade 3 ptosis***	21 (34%)

TABLE 1: Demographic, medical, and preoperative characteristics of patients undergoing double-incision chest masculinization surgery with free nipple grafting (N = 61).

*Immunosuppressive medications included intermittent prednisone or methylprednisolone for asthma flares; oral cyclosporine for atopic dermatitis; and omalizumab for mast cell activation syndrome.

**Hematologic conditions included anemia, thrombocytopenia, erythrocytosis, polycythemia, thrombocytosis, sickle cell trait, history of deep vein thrombosis, Von Willebrand disease, and Factor V Leiden.

***Ptosis was classified according to the Regnault system [6]: Grade 1, nipple at the level of the IMF but above the inferior breast contour; Grade 2, nipple below the IMF but above the inferior breast contour; and Grade 3, nipple below the IMF at the lowest point of the breast contour.

More than 85% of patients (n = 52, 85.2%) had a documented psychiatric diagnosis, including depression, anxiety, post-traumatic stress disorder (PTSD), and attention-deficit/hyperactivity disorder (ADHD). Additionally, 72.1% (n = 44) had at least one medical comorbidity, most commonly hematologic conditions (e.g., iron deficiency anemia and chronic anemia; n = 9, 14.8%) and hypertension (n = 5, 8.2%). More than half of patients (n = 34, 55.7%) reported a history of tobacco, marijuana, or vape use, and 9.8% (n = 6) had undergone prior gender-affirming hysterectomy. The mean age of hormone therapy initiation was 24.8 ± 8.6

years. Most patients demonstrated some degree of breast ptosis preoperatively, with grade 2 ptosis present in 37.7% (n = 23) and grade 3 ptosis in 34.4% (n = 21) of patients.

Surgical outcomes

Postoperative hematoma occurred in 4.9% (n = 3) of patients, seroma in 1.6% (n = 1), wound dehiscence requiring intervention in 8.2% (n = 5), and infection in 19.7% (n = 12). No patients experienced VTE, PE, blood transfusion, AKI, UTI, pneumonia, or sepsis. Complete postoperative outcomes are summarized in Table 2.

Outcome	Value
Surgical outcomes	
Infection requiring antibiotics	12 (20%)
Hematoma	3 (4.9%)
Seroma	1 (1.6%)
Wound dehiscence requiring intervention	5 (8.2%)
Skin necrosis	2 (3.3%)
Nipple graft failure	2 (3.3%)
Venous thromboembolism	0
Drain duration, days	11.2 ± 6.1
Aesthetic outcomes	
Dog-ear deformity	9 (15%)
Scar widening	9 (15%)
Hypertrophic scarring	6 (9.8%)
Revision procedures	
Scar revision	3 (4.9%)
Dog-ear revision	5 (8.2%)

TABLE 2: Postoperative surgical and aesthetic outcomes following double-incision chest masculinization surgery with free nipple grafting (N = 61).

Aesthetic outcomes

Aesthetic complications occurred in 32.8% (n = 20) of patients, most commonly dog-ear deformity (14.8%, n = 9) and scar widening (14.8%, n = 9). Revision procedures included scar revision in 4.9% (n = 3) and dog-ear revision in 8.2% (n = 5) of patients (Table 2). Representative postoperative outcomes are shown in Figures 6-7.



FIGURE 6: Representative preoperative (a) and postoperative (b) outcomes following double-incision mastectomy with free nipple grafting.

Potentially identifying features were digitally removed or obscured to protect patient privacy; no clinically relevant anatomy was altered.



FIGURE 7: Representative preoperative and postoperative outcomes following double-incision mastectomy with free nipple grafting in patients with elevated BMI: (a) BMI 40.2 kg/m² and (b) BMI 40.0 kg/m².

Potentially identifying features were digitally removed or obscured to protect patient privacy; no clinically relevant anatomy was altered.

Discussion

In this single-surgeon series, we describe a standardized operative approach for double-incision CMS with free nipple grafting and report associated surgical and aesthetic outcomes. Rather than proposing a novel technique, this study highlights practical operative considerations that may improve reproducibility and inform surgical planning in gender-affirming chest surgery. Across our cohort, rates of hematoma, seroma, revision procedures, and nipple graft loss were comparable to previously reported series [7,8].

Preoperative planning and patient selection

Preoperative markings play an important role in flap symmetry, scar positioning, and chest contouring. Standardized markings may improve contour consistency, particularly in patients with significant ptosis or elevated BMI. Prior studies in breast and gender-affirming surgery similarly support the value of standardized preoperative markings in operative planning and symmetry [9,10].

Appropriate patient selection also remains central to surgical planning. Although double-incision mastectomy with free nipple grafting remains one of the most widely utilized approaches for patients with larger chest size or significant ptosis, alternative techniques may be more appropriate in selected patients. Patients without significant skin laxity may benefit from limited-incision approaches, while patients prioritizing preservation of nipple sensation may be candidates for nipple-preserving or pedicled techniques. Similarly, patients with pseudoptosis or a high native NAC position may benefit from alternative incision patterns, including the inferior-ellipse technique described by Robinson et al. [11]. Preoperative counseling regarding scar placement, contour expectations, and nipple sensation remains essential.

Comprehensive preoperative assessment extends beyond anatomic considerations. More than 85% of patients in our cohort had a documented psychiatric diagnosis, most commonly depression and anxiety, consistent with prior reports in TGD populations [12]. Patients underwent multidisciplinary evaluation according to institutional gender-affirming surgery protocols, including assessment of readiness for surgery and mental health support when indicated. These findings underscore the importance of comprehensive gender-affirming care that addresses both surgical and psychosocial needs.

Hemostasis and seroma reduction

In our cohort, hematoma prevention incorporated several complementary strategies, including tumescent infiltration, electrocautery dissection, intraoperative TXA administration, Valsalva maneuver prior to closure, drain placement, and postoperative compression. Prior studies in reduction mammaplasty and mastectomy have demonstrated that tumescent infiltration may facilitate dissection and improve hemostasis [3,13]. Tumescent infiltration hydrostatically separates tissue planes and may facilitate visualization and hemostasis. Similarly, electrocautery remains widely used in breast surgery to maintain intraoperative hemostatic control [14,15].

Our cohort demonstrated a hematoma rate of 4.9%, which compares favorably with previously reported rates ranging from 5.4% to 21% following CMS [7]. Seroma occurred in 1.6% of patients. Closed-suction drains and postoperative compression garments were used routinely to reduce fluid accumulation and support flap adherence during early healing. Although evidence regarding optimal drain management in CMS remains variable, our findings support the selective use of drains in patients undergoing extensive dissection or contouring.

Contour optimization and scar management

Chest contour remains a major determinant of aesthetic outcome following CMS [16]. In our experience, direct excision of redundant lateral tissue and inferior undermining below the IMF were reliable strategies for optimizing contour transitions and reducing residual fullness along the lateral chest wall. Intraoperative assessment in both supine and upright positioning also allowed for real-time contour adjustments.

Postoperative aesthetic concerns in our cohort most commonly included dog-ear deformity and scar widening. These outcomes may reflect the challenges of contouring in patients with elevated BMI, significant ptosis, or extensive lateral tissue redundancy. Deliberate incision planning during preoperative marking, layered closure, postoperative compression, and silicone scar therapy were used routinely to support wound healing and scar maturation [17,18]. Although aesthetic concerns remained relatively common, revision procedures were less frequent.

NAC reconstruction

NAC reconstruction remains an important component of CMS. Typical masculine NAC characteristics include a smaller, oval-shaped appearance positioned along the inferolateral border of the pectoralis major [19,20]. In our operative approach, attention was placed on graft sizing, positioning, thinning, and bolster dressing application to support graft take and long-term contour.

Prior studies have demonstrated that NAC dimensions and orientation may change over time following surgery, potentially contributing to decreased patient satisfaction [21]. These findings underscore the importance of thoughtful preoperative planning and patient counseling regarding expected postoperative evolution of the NAC.

Although free nipple grafting remains widely utilized in patients with larger chest size or significant ptosis, this technique involves trade-offs, including reduced or lost nipple sensation and diminished erectile function of the NAC [22-24]. These considerations were discussed preoperatively with patients, and alternative nipple-preserving approaches may be appropriate in selected individuals. In our cohort, nipple graft failure occurred in 3.3% of patients, which is comparable to or lower than previously reported rates [8]. Low graft loss rates in our cohort may relate to the use of bolster dressings, graft thinning, and dermal tacking sutures [25].

Limitations

This study has several limitations. As a retrospective single-surgeon series without a comparison cohort, causal relationships between specific operative modifications and postoperative outcomes cannot be established. Future prospective studies comparing operative strategies may help clarify the individual contribution of specific technical refinements to surgical and aesthetic outcomes. Follow-up duration was variable and may not fully capture long-term scar maturation, contour evolution, or delayed revision procedures. Longer-term follow-up studies are needed to better characterize postoperative contour changes and scar outcomes over time. In addition, patient-reported outcomes, including satisfaction, chest dysphoria, nipple sensation, and aesthetic perception, were not systematically collected. Reported aesthetic outcomes therefore reflect surgeon-assessed postoperative findings rather than patient-reported aesthetic satisfaction. Future studies incorporating validated patient-reported outcome measures may provide additional insight into aesthetic satisfaction, quality of life, and functional outcomes following CMS. Finally, as a single-surgeon series, findings may reflect surgeon-specific technique and experience and may not be generalizable to other patient populations or operative approaches. Future prospective multicenter studies incorporating patient-reported outcomes and longer follow-up are needed to further evaluate how body habitus, tissue distribution, and intraoperative decision-making influence long-term aesthetic outcomes and revision rates in CMS.

Conclusions

This study describes a standardized operative approach for double-incision CMS with free nipple grafting and reports associated surgical and aesthetic outcomes from a single-surgeon series. These operative considerations may improve reproducibility and help optimize outcomes in gender-affirming chest surgery. Future prospective studies incorporating patient-reported outcomes and longer follow-up are needed to further evaluate long-term aesthetic and functional outcomes.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

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Drafting of the manuscript: Camille F. Blackman, Diane Saab, Margaret R. Wang

Critical review of the manuscript for important intellectual content: Camille F. Blackman, Armina Azizi, Wendy Chen, Fan Liang

Supervision: Fan Liang

Disclosures

Human subjects: Informed consent for treatment and open access publication was obtained or waived by all participants in this study. Johns Hopkins Medicine Institutional Review Board issued approval IRB00368337. **Animal subjects:** All authors have confirmed that this study did not involve animal subjects or tissue. **Conflicts of interest:** In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

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References

1. Aquino NJ, Goobie SM, Staffa SJ, Eastburn E, Ganor O, Jones CT: Implementation of an enhanced recovery after surgery pathway for transgender and gender-diverse individuals undergoing chest reconstruction surgery: an observational cohort study. J Clin Med. 2023, 12:7083. 10.3390/jcm12227083
2. Zhu J, Wang E, Liu S, Koos J, Shroyer L, Krajewski A: Impact of surgical technique on outcome measures in chest masculinization: a systemic review and meta-analysis. J Plast Reconstr Aesthet Surg. 2023, 87:109-16. 10.1016/j.bjps.2023.09.002
3. Arrica G, Tettamanzi M, Ziani F, Filigheddu E, Trignano C, Rubino C, Trignano E: Advancing reduction mammaplasty surgery: advancements and outcomes with tumescent local anaesthesia. Aesthetic Plast Surg. 2025, 49:1708-14. 10.1007/s00266-024-04412-4
4. Yang Y, Zhu J, Qian X, Feng J, Sun F: Complication differences between the tumescent and non-tumescent dissection techniques for mastectomy: a meta-analysis. Front Oncol. 2021, 11:648955. 10.3389/fonc.2021.648955
5. Baker E, Piper J: Drainless mastectomy: is it safe and effective?. Surgeon. 2017, 15:267-71. 10.1016/j.surge.2015.12.007
6. Regnault P: Breast ptosis. Definition and treatment. Clin Plast Surg. 1976, 3:193-203. 10.1016/S0094-1298(20)30220-0
7. Etemad SA, Poh MM: Enhanced recovery after gender-affirming surgery. Aesthet Surg J. 2024, 44:S3-S14. 10.1093/asj/sjae082
8. Frey JD, Yu JZ, Poudrier G, Motosko CC, Saia WV, Wilson SC, Hazen A: Modified nipple flap with free areolar graft for component nipple-areola complex construction: outcomes with a novel technique for chest wall reconstruction in transgender men. Plast Reconstr Surg. 2018, 142:331-6. 10.1097/PRS.0000000000004551
9. Deo SVS: Breast Oncoplasty and Reconstruction: Principles and Practice. Springer Nature, Singapore; 2023. 10.1007/978-981-99-5536-7
10. Elia R, Maruccia M, Tedeschi P, Nacchiero E, Giudice G: The “Mosque Tower Pattern” for the preoperative marking of reduction mammaplasty. Plast Reconstr Surg Glob Open. 2024, 12:e6230.

10.1097/GOX.0000000000006230
11. Robinson IS, Salibian A, Zhao LC, Bluebond-Langner R: Nipple-preserving inferior-ellipse mastectomy: a new technique for gender-affirming top surgery. Plast Reconstr Surg. 2024, 154:237e-40e. 10.1097/PRS.0000000000011046
12. National Academies of Sciences, Engineering, and Medicine: Sex and Gender Identification and Implications for Disability Evaluation. The National Academies Press, Washington, DC; 2024. 10.17226/27775
13. Bakillah E, Brooks AD, Adekeye S: Switching to tumescent dissection in mastectomy. Breast J. 2025, 2025:7634729. 10.1155/tbj/7634729
14. Carr-Locke DL, Day J: Principles of electrosurgery. Successful Training in Gastrointestinal Endoscopy. Cohen J (ed): Wiley, 2011. 125-34. 10.1002/9781444397772.ch11
15. Grochola LF, Vonlanthen R: Surgical energy devices or devices for hemostasis. Atlas of Upper Gastrointestinal and Hepato-Pancreato-Biliary Surgery. Clavien PA, Sarr MG, Fong Y, et al. (ed): Springer, Berlin, Heidelberg; 2016. 37-44. 10.1007/978-3-662-46546-2_6
16. Saarinen ML: Chest Masculinization in Transgender Men - Clinical Outcomes, Aesthetic Result, and Health-Related Quality of Life. University of Helsinki, 2025.
17. Téot L, Mustoe TA, Middelkoop E, Gauglitz GG: Textbook on Scar Management: State of the Art Management and Emerging Technologies. Springer International Publishing, 2020. 10.1007/978-3-030-44766-3
18. Van Den Kerckhove E, Stappaerts K, Boeckx W, et al.: Silicones in the rehabilitation of burns: a review and overview. Burns. 2001, 27:205-14. 10.1016/S0305-4179(00)00102-9
19. Timmermans FW, Ruyssinck L, Mokken SE, et al.: An external validation of a novel predictive algorithm for male nipple areolar positioning: an improvement to current practice through a multicenter endeavor. J Plast Surg Hand Surg. 2023, 57:103-8. 10.1080/2000656X.2021.1994982
20. Agarwal CA, Wall VT, Mehta ST, Donato DP, Walzer NK: Creation of an aesthetic male nipple areolar complex in female-to-male transgender chest reconstruction. Aesthetic Plast Surg. 2017, 41:1305-10. 10.1007/s00266-017-0935-7
21. Timmermans FW, Elfering L, Smit JM, van de Grift TC, Bouman MB, Mullender MG: Long-term changes in free nipple graft morphology and patient-reported outcomes in gender-affirming mastectomies. Aesthetic Plast Surg. 2022, 46:2174-80. 10.1007/s00266-021-02666-w
22. Olson-Kennedy J, Warus J, Okonta V, Belzer M, Clark LF: Chest reconstruction and chest dysphoria in transmasculine minors and young adults: comparisons of nonsurgical and postsurgical cohorts. JAMA Pediatr. 2018, 172:431-6. 10.1001/jamapediatrics.2017.5440
23. Lang CL, Day DL, Klit A, Mejdahl MK, Holmgaard R: Low risk of persistent pain, sensory disturbances, and complications following mastectomy after gender-affirming surgery. Transgend Health. 2021, 6:188-93. 10.1089/trgh.2020.0070
24. Remy K, Fruge SE, McCulloch IL, et al.: Reinnervation of free nipple grafts associated with improved erection function. Plast Reconstr Surg Glob Open. 2025, 13:e6418. 10.1097/GOX.0000000000006418
25. Kuruoglu D, Alsayed AS, Melson VA, Figueroa NS, Fahradyan V, Martinez-Jorge J: Masculinizing chest wall gender-affirming surgery: clinical outcomes of 73 subcutaneous mastectomies using the double-incision and semicircular incision techniques. J Plast Reconstr Aesthet Surg. 2023, 85:515-22. 10.1016/j.bjps.2023.02.020