

# Age-related Outcomes of Chest Masculinization Surgery: A Single-surgeon Retrospective Cohort Study

Ron Skorochod, MD\*†  
Roman Rysin, MD\*†  
Yoram Wolf, MD\*

**Background:** Many transmasculine individuals face chest dysphoria, an emotional distress associated with breast development. The definitive management for reduction of existing breast tissue and alleviation of chest dysphoria comes in the form of chest masculinization surgery. Over the years, a substantial increase in the number of youth seeking gender-affirming chest masculinization surgery was observed globally. The study was hypothesized to answer the question as to whether the age limit of chest masculinization surgery should be lowered to include adolescents.

**Methods:** A retrospective cohort study was conducted, based on the experience of a single surgeon over a period of 20 years.

**Results:** Two-hundred eight patients were included in this cohort. Patients were divided into two equal groups based on their age. No statistically significant differences between the groups were observed in terms of resected breast tissue ( $P = 0.62$  and  $0.30$ , for the right and left breast, accordingly), auxiliary liposuction ( $P = 0.30$ ), liposuction volume ( $P = 0.20$ ), procedure ( $P = 0.15$ ), postoperative drains ( $P = 0.79$ ), and surgery duration ( $P = 0.72$ ). Statistically significant differences were found in the 18 years or younger group, with lower rates of complication ( $P < 0.001$ ), lower rates of revision surgery ( $P = 0.025$ ), and higher satisfaction rankings ( $P < 0.001$ ). Apart from age, no other factors were found to potentially explain the different rates of complications between the age groups.

**Conclusion:** Patients aged 18 or younger opting for chest masculinization surgery experience fewer complications and revision procedures while having higher satisfaction rates with the surgical outcome. (*Plast Reconstr Surg Glob Open* 2023; 11:e4799; doi: 10.1097/GOX.0000000000004799; Published online 20 February 2023.)

## INTRODUCTION

The term gender dysphoria is often used to describe the subjective feeling of incompatibility of the sex assigned at birth and the gender individuals identify with. Transmasculine individuals identify their gender as male, or along the masculine spectrum, despite being assigned a female sex at birth.<sup>1,2</sup>

Transgender individuals face extremely high rates of psychological distress, including depression and anxiety,

which in some cases may even lead to self-harm and suicidal actions.<sup>3–5</sup>

Over the last decade, an unprecedented number of youths was reported to present at gender-specific centers across the world, seeking care related to feelings of gender dysphoria.<sup>6,7</sup>

Previous large-scale studies found that transmasculine youth represent north of 50% prevalence of reported past suicide attempts, the highest rate among youth of all gender identities.<sup>8</sup>

Many transmasculine individuals express feelings of chest dysphoria, a term that describes physical and emotional discomfort or distress that is associated with unwanted breast development.<sup>9</sup> Despite the introduction of gonadotropin-releasing hormone (GnRH) agonists for pubertal suppression, a significant portion of transmasculine youth have already experienced irreversible breast development before receiving hormonal therapy from specialized clinics.<sup>6</sup>

From the \*Plastic Surgery Unit, Hillel Yaffe Medical Center, Hadera, Israel; and †Ruth and Bruce Rappaport Faculty of Medicine, Technion—Israel Institute of Technology, Haifa, Israel. Received for publication November 15, 2022; accepted December 6, 2022.

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The definitive management for reduction of the existing breast tissue and alleviation of chest dysphoria comes in the form of chest masculinization surgery. The procedure consists of bilateral mastectomy with nipple-sparing, nipple-areola complex (NAC) flap transposition or free NAC graft and resizing of the existing nipple and areola, for optimal masculine chest contour.<sup>10</sup>

Numerous studies of transmasculine adults have demonstrated high rates of satisfaction, low complication rates, and a significant mental health improvement following chest masculinization surgery.<sup>11–15</sup>

Current international practice guidelines focusing on the care of transgender individuals state that chest masculinization surgery should be performed according to physical and mental health status, with consideration of their gender expression goals.<sup>16,17</sup> Despite not mentioning a minimal age from which an individual can undergo the procedure, the vast majority of US insurance companies consider the minimal age for the procedure to be 18 years.<sup>17,18</sup>

In attempt to better understand the surgical implications of chest masculinization surgery in adolescents, we conducted a retrospective cohort study comparing the surgical outcomes between adolescents and adults. The study was hypothesized to answer the question as to whether the age limit of chest masculinization surgery should be lowered to include adolescents.

In the current literature, this is the first cohort study to investigate surgical outcomes of chest masculinization surgery in adolescents.

## PATIENTS AND METHODS

This retrospective cohort study was performed after receiving approval from the local ethics committee and was conducted according to the Helsinki declaration.

Data was collected from the medical files of all patients who underwent chest masculinization surgery by the senior author (Y.W.) between the years 2000 and 2021. Patients with incomplete medical records or those reluctant to adhere to follow-up were excluded from the study.

Minimal follow-up time was defined as 90 days. Patient's refusing to adhere to this minimal follow-up time, or those lost to follow-up, were excluded from the study and, therefore, the statistical analysis. In total, three patients were excluded for these reasons, accounting for a total of 1.4% of the initial study population.

After reviewing the medical files of patients included in the cohort, demographic, clinical, and surgical characteristics were collected. Demographic characteristics included patients' age, body mass index (BMI), comorbidities, and smoking history. Clinical and surgical characteristics included previous hormone replacement therapy, a surgical procedure which the patients underwent, duration of surgery, surgery-related complications, need for revision surgery, and patient satisfaction.

Patient satisfaction was recorded twice, at 30 and 90 days postoperatively. The average score from the two recordings was calculated, and is reported in this study.

## Takeaways

**Question:** What are the outcomes of chest masculinization surgery in transgender adolescents and how do they compare to those of adults.

**Findings:** The medical files of two-hundred eight patients were screened and analyzed. Surgical duration, postoperative complications, patient satisfaction and need for surgical revision were defined as end outcomes and statistically analyzed. Adolescent patients were found to have lower rates of complications and need for revision surgery. Additionally, adolescent patients displayed higher satisfaction rankings in comparison to the adult subgroup.

**Meaning:** Chest masculinization surgery is physically safe in adolescent patients and produces satisfactory results.

Minor complications were defined as those resolving with conservative therapy (Clavien–Dindo grades 1 and 2) and major complications as those requiring surgical intervention under local or general anesthesia (Clavien–Dindo grade 3). Patient satisfaction was evaluated using the “Likert satisfaction scale.” Patients ranked their satisfaction with the aesthetic results on a scale of 1 to 5, where 1 translates to “unsatisfactory results” and 5 translates to “very satisfactory results.”

Criteria for surgery included gender dysphoria causing severe emotional distress, as evaluated by at least one mental health specialist with an advanced academic degree; parental consent (in cases of minor patients); and no severe medical comorbidities.

## STATISTICAL ANALYSIS

Statistical analysis was performed using the commercial software Statistical Package for Social Science (SPSS Version 24.0, IBM Corp, Chicago, Ill.); descriptive statistics analysis was computed for each sample size. Continuous variables were expressed as mean  $\pm$  SD, and categorical variables were expressed as frequencies.

Categorical variables were tested using the chi-square test or Fisher exact test, as appropriate. Continuous variables were examined using the Student *t* test if normally distributed and Man–Whitney test if not. To identify variables associated with the primary outcome measure, univariate analysis was performed. Variables were considered significantly associated if a *P* value less than 0.05 was observed in the univariate analysis.

## RESULTS

Two-hundred eight patients were included in this retrospective cohort. Patients were randomly divided into two equal groups based on their age. The first group included 104 patients aged 18 years or younger, whereas the second group included 104 patients aged 19 years and older (Fig. 1). No notable differences were seen between the preoperative characteristics of the patients in a statistical analysis. Preoperative patient characteristics and their statistical comparison, stratified to age groups, can be seen in Table 1.

## Age Distribution in the ≤ 18 years Group

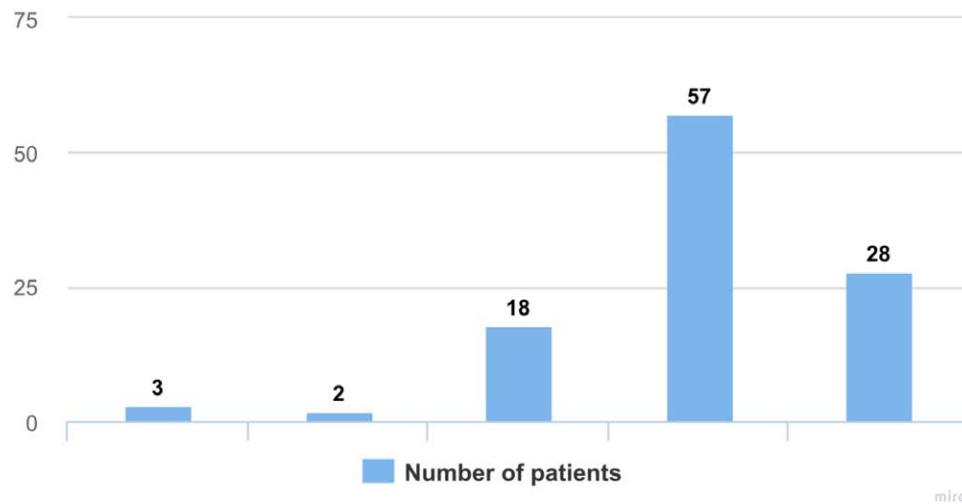


Fig. 1. Graph representation of the age distribution in the ≤18 years of age subgroup.

Table 1. Preoperative Characteristics of Study Participants, in Relation to Age at Time of Surgery

	Total, N = 104	Age ≤ 18, N = 104	Age > 18, N = 104	P
Age, average ± STD (range)	22.7±7.65	16.95±0.72 (14–18 y)	28.4±7.12 (19–50 y)	
BMI, average ± STD	24.8±2.74	24.9±2.87	24.8±2.60	0.53
Hormone replacement therapy	93 (45%)	50 (48%)	43 (41%)	0.40
Tobacco smoking	57 (27%)	28 (27%)	29 (28%)	1.00
Hypertension	2 (1%)	2 (2%)	0	0.49
DM	8 (3.8%)	3 (2.9%)	5 (4.8%)	0.72
IBD	1 (0.5%)	0	1	1.00
Hypothyroidism	9 (4.3%)	2 (1.9%)	7 (6.7%)	0.17
Psychiatric comorbidities	26 (12.5%)	12 (11.5%)	14 (13.5%)	0.83
Epilepsy	2 (1.0%)	2 (1.9%)	0	0.49
Asthma	14 (6.7%)	3 (2.9%)	11 (10.6%)	<b>0.049</b>
Migraines	1	0	1	1.00
Charlson comorbidity index	12 (5.8%)	3 (2.9%)	9 (8.7%)	0.13
Preoperative laboratory				
Glucose	86.2±10.0	86.7±10.0	85.7±10.0	0.51
HB	13.96±1.48	13.9±1.4	14.1±1.5	0.31
PLT	271.3±62.4	275.1±59.5	257.6±65.2	0.39
Follow-up, d, average ± STD	1805±1646	1443±1200	2166±1934	<b>0.001</b>

DM, diabetes mellitus; HB, hemoglobin; IBD, inflammatory bowel disease; IQR, in quarter range; PLT, platelets.

Values in boldface indicate  $p < 0.05$ .

Fifty of the patients in the 18 years or younger group received hormone replacement therapy (HRT), accounting for 47.6% of the subgroup. The average age at which the adolescent patient started HRT was 15 years with an average duration of therapy of 18 months before surgery.

Analysis of surgical characteristics demonstrated no statistically significant difference between the groups in terms of resected breast tissue weight ( $P = 0.62$  and  $0.30$ , for the right and left breasts, accordingly), auxiliary liposuction ( $P = 0.30$ ), and volume of liposuction ( $P = 0.20$ ). Procedure type ( $P = 0.15$ ), insertion of postoperative drains ( $P = 0.79$ ), and the duration of surgery ( $P = 0.72$ ). Statistically significant differences between the groups were noted, with the 18 years or younger group having

lower rates of complication ( $P < 0.001$ ), lower rates of revision surgery ( $P = 0.025$ ), and higher satisfaction rankings ( $P < 0.001$ ) (Table 2).

In our study, three patients had postoperative complications requiring surgical intervention under local or general anesthesia. Two of these patients had NAC ischemia, and the other patient had hematoma requiring surgical drainage in the operating room.

To better understand the difference in complication rates between the two age groups, a university analysis was conducted to determine associations between preoperative patient characteristics and the development of postoperative complications (Table 3). The results demonstrated no statistically significant associations between

**Table 2. Surgical Characteristics of Study Participants, in Relation to Age at Time of Surgery**

	Total, N = 208	Age ≤ 18, N = 104	Age > 18, N = 104	P
Resected tissue weight (right breast), average ± STD	474.5±343	462.5±326	486.5±359	0.62
Resected tissue weight (left breast), average ± STD	475.9±370	449.5±327	502.5±408	0.30
Liposuction				0.30
No	165 (79%)	86 (83%)	79 (76%)	
Yes	43 (21%)	18 (17%)	25 (24%)	
Liposuction volume, median [IQR]	300 [200–600]	300 [187–500]	350 [225–800]	0.20
Procedure type				0.15
Periareolar mastectomy	31 (15%)	17 (17%)	14 (13%)	
NAC on scar	5 (2%)	0	5 (5%)	
NAC flap	61 (29%)	31 (30%)	30 (29%)	
Free NAC graft	110 (53%)	55 (53%)	55 (53%)	
Postoperative drains	195 (93%)	97 (93%)	95 (92%)	0.79
Duration of surgery	02:04±0:26	02:03±0:25	02:05±0:27	0.72
Complications	64 (31%)	20 (19%)	44 (42%)	<b>&lt;0.001</b>
Seroma	18 (8.7%)	3 (2.9%)	15 (14.4%)	<b>0.005</b>
Hypertrophic scars	18 (8.7%)	7 (6.7%)	11 (10.6%)	0.46
Hematoma	14 (6.7%)	6 (5.8%)	8 (7.7%)	0.78
Wound dehiscence	4 (1.9%)	3 (2.9%)	1 (1%)	0.49
NAC ischemia	2 (1%)	0	2 (2%)	0.62
Infection	0	0	0	
Thromboembolism	0	0	0	
Patient satisfaction	3.94±0.97	4.3±0.76	3.60±1.03	<b>&lt;0.001</b>
Revision surgery	23 (11%)	6 (5.8%)	17 (16.3%)	<b>0.025</b>
Hematoma drainage	1	0	1	
NAC ischemia	2	0	2	
Nipple circumference alteration	5	2	3	
Scar revision	5	2	3	
Liposuction	10	2	8	

Values in boldface indicate  $p < 0.05$ .

**Table 3. Associations between Preoperative Characteristics of Study Participants and the Development of Postoperative Complications**

	Total, N = 208	Did Not Develop Complications (n = 114)	Did Develop Complications (n = 64)	P
Age, average ± STD	7.6±22.7	6.6±21.3	8.9±25.7	<b>&lt;0.001</b>
Age ≤ 18	104 (50%)	84 (58%)	20 (31%)	<b>&lt;0.001</b>
Age > 18	104 (50%)	60 (42%)	44 (69%)	
BMI, average ± STD	24.8±2.7	24.7±2.8	24.9±2.5	0.55
Hormone replacement therapy	93 (45%)	67 (46.5%)	26 (41%)	0.45
Tobacco smoking	57 (27%)	34 (24%)	23 (36%)	0.091
Hypertension	2 (1%)	2 (1%)	0	1.00
DM	8 (3.8%)	6 (4.2%)	2 (3.1%)	1.00
IBD	1 (0.5%)	1 (0.5%)	0	
Hypothyroidism	9 (4.3%)	5 (3.5%)	4 (6.3%)	0.46
Psychiatric comorbidities	26 (12.5%)	20 (13.9%)	6 (9.4%)	0.49
Epilepsy	2 (1%)	2 (1%)	0	1.00
Asthma	14 (6.7%)	11 (7.6%)	3 (4.7%)	0.55
Migraines	1 (0.5%)	1 (0.5%)	0	
Charlson comorbidity index	12 (5.8%)	7 (4.9%)	5 (7.8%)	0.52
Preoperative laboratory				
Glucose	86.2±10.0	86.5±9.9	85.6±10.4	0.55
HB	13.9±4.5	13.9±1.4	13.9±1.7	0.94
PLT	265 [230–312]	264 [228–310]	269 [234–319]	0.59
Follow-up, d, average ± STD	1306 [653–2069]	1340 [658–1811]	1208 [644–3346]	0.33

Values in boldface indicate  $p < 0.05$ .

**Table 4. Associations between Surgical Characteristics of Study Participants and the Development of Postoperative Complications**

	Total, N = 208	Did Not Develop Complications (n = 114)	Did Develop Complications (n = 64)	P
Resected tissue weight (right breast), average ± STD	474.5±343	503±364	408±280	0.066
Resected tissue weight (left breast), average ± STD	475±370	509±402	400±272	0.051
Liposuction				0.85
Not performed	165 (79%)	115 (80%)	50 (78%)	
Performed	43 (21%)	29 (20%)	14 (22%)	
Liposuction volume, median [IQR]	300 [200–600]	300 [225–550]	375 [200–650]	0.72
Procedure type				0.15
Periareolar mastectomy	31 (15%)	18 (13%)	13 (20%)	
NAC on scar	5 (2%)	2 (1%)	3 (5%)	
NAC flap	61 (30%)	41 (29%)	20 (31%)	
Free NAC graft	110 (53%)	82 (57%)	28 (44%)	
Postoperative drains	192 (93%)	133 (92%)	59 (94%)	1.00
Duration of surgery (h), average ± STD	02:04±0:26	02:02±0:28	02:08±0:22	0.18
Patient satisfaction	3.94±0.97	3.94±0.95	3.94±1.0	0.96
Revision surgery	23 (11%)	15 (10%)	8 (12.5%)	0.64

any of the preoperative characteristics apart from age. Complications were additionally assessed for associations with surgical characteristics, and again, demonstrated no statistically significant associations (Table 4).

## DISCUSSION

Implications of age on surgical and postoperative complications have been extensively studied in various surgical fields. In light of constant improvements in surgical procedures and their safety profiles, elective procedures have begun to extend toward the pediatric and adolescent age group as well. Reports of studies from different surgical fields consistently report noninferior or even superior results when operating on younger patients.<sup>19–22</sup>

The world Professional Association for Transgender Health (WPATH) and the Endocrine Society state in their standard of care guidelines that there is insufficient evidence to recommend a specific age requirement for chest masculinization surgery. Moreover, clinicians must determine the optimal timing of chest surgery for transmasculine individuals based upon the physical and mental health status of the patient.<sup>23,24</sup>

Analysis of our cohort demonstrated statistically significant differences in complication rates, need for revision surgery, and patient satisfaction between individuals 18 years of age or younger and their counterparts. The younger group experienced a lower rate of complications and need for revision surgery while having higher postoperative satisfaction. Analysis of factors potentially influencing the association between age and complication rate demonstrated no other statistically significant variables, implying that age is the only statistically significant variable in this cohort responsible for the lower complication rate in the adolescent group.

The results of our study contradict a previous study by Olson-Kennedy et al,<sup>9</sup> which reported an equal rate of complication between patient ages older and younger than 18 years. Several plausible explanations exist for this

difference. The cohort study conducted by our peers consisted of a substantially lower number of participants (n = 68) in comparison to ours (n = 208). Additionally, the average age of participants in the two groups compared by Olson-Kennedy et al was very similar with 17 and 19 years of age. Whereas in our study, although the average age in the adolescent group was also 17 years, the average age of the adult group was 28.4 years.

In the United States, despite the improvement of gender-affirming care measures, insurance coverage for chest masculinization surgery and other gender-affirming services remain suboptimal for transgender youth.

In their study, Dowshen et al<sup>25</sup> reported the inadequacy of insurance coverage for gender-affirming care in transgender youth using an analysis of online health insurance plan indications. The authors reviewed 36 insurance plans, 22 commercial and 14 Medicaid, and found that fewer than half of the plans indicated coverage of any service, no plans indicated coverage of all four categories of recommended services, and nearly half of the plans indicated transgender-specific exclusions. These findings support the results obtained from the National Transgender Discrimination Survey,<sup>26</sup> where 50% of transgender patients reported denial of coverage for gender-affirming surgery and 25% reported denial for HRT.

Mehring et al<sup>17</sup> conducted a prospective study, in attempt to better voice transmasculine individuals' opinion on masculinizing chest surgery (MCS) and chest dysphoria. Their research put light on several recurring themes expressing the improvement in quality of life in adolescents after MCS. In their cohort of 30 patients, 16 have yet to undergo MCS (53%). Despite acknowledging the risks and irreversibility of the procedure, they all expressed confidence in the decision to pursue it; stating the surgery is critical for improving their quality of life and functioning.

Another reoccurring theme was the complete or near-complete resolution of chest dysphoria in all individuals

who had previously undergone MCS. The satisfaction with the results was accompanied by a lack of regret to pursue the procedure, regardless of the surgical technique used. The resolution of chest dysphoria led to improvements in mood, confidence, self-esteem, interpersonal relationships, and physical activity.<sup>17</sup>

As a result of the strict requirement of insurance company for the coverage of chest masculinization surgery, the vast majority of patients in the Mehringer et al study paid the extensive surgical fees out of their pocket. Adolescents who have not yet undergone the surgery stated that financial considerations separated them from the desired procedure, making the barrier between physical-appearance dysphoria and its resolution a financial one.

In our opinion, although age does not qualify to be the determining criterion for the eligibility for chest masculinizing therapy, several other factors could be considered in combination to determine the potential outcome and benefit of the surgical procedure. Evaluation of gender dysphoria and its impact on the individual's life should be carried out by an experienced mental health specialist. Understanding the burden of gender dysphoria, which each adolescent is experiencing, could better reflect the postoperative outcomes in terms of satisfaction or regret and evaluate the mental health preparedness for such a gender-affirming surgery. Additionally, learning about the supporting close circle of the patient and receiving consent for surgery from their parents could aid in ensuring proper rehabilitation, affirmations, and support, which bear the ability to improve patient satisfaction and decrease postoperative distress. Although the use of puberty blockades and hormone replacement therapy for a prolonged period of time can assist the multidisciplinary team in ensuring that the patients are mentally prepared for the transition, we do not find it to be a necessity. As previous studies demonstrated lack of insurance coverage for gender-affirming care, many individuals do not have the financial possibility to acquire the medications privately. In attempt to decrease the potential financial bias, we believe that a thorough psychological evaluation of the patient by an experienced mental health specialist, in addition to ensuring the support of the individual's close circle, is an adequate parameter to evaluate the patient's mental preparedness for surgery, regardless of the previous use of HRT or age.

This retrospective cohort bears several limitations worth mentioning. Most importantly, the retrospective nature of our study. Moreover, despite discussing and comparing the patients' satisfaction with the surgical results, its assessment and grading system were a subjective one. The need for a validated, objective, and uniform assessment tool for chest masculinization surgery outcomes is required for a more thorough analysis of patient satisfaction and postoperative regret. Additionally, a longer follow-up period could demonstrate further implications of the patients' age on surgical outcomes.

Although the study presents statistically significant results, several confounding factors should be addressed as well. The single surgeon's experience presented in this study provides more consistent results that are less prone

to confounders concerning the professional aspect of the procedures; it is prone to the natural change, experience, and learning curve that is to be expected over the study period. With the societal shifts toward a more accepting society, transgender patients face less stigma and discrimination than in previous years, which could possibly contribute to increased satisfaction rate.

In conclusion, patients aged 18 years or younger opting for chest masculinization surgery experience fewer complications and revision procedures while having higher satisfaction rates with the surgical outcome. Although current international guidelines refrain from mentioning an objective minimal age for patients interested in the procedure, the vast majority of insurance companies deny coverage for patients of minor age. Further studies on the long-term outcomes of chest masculinization surgery in adolescents are required to ensure the safety and importance of this procedure in this age group.

**Ron Skorochod, MD**

School of Medicine

Hadassah Medical Organization and Faculty of Medicine

Hebrew University of Jerusalem, Israel

E-mail: [Ronskorochod@mail.huji.ac.il](mailto:Ronskorochod@mail.huji.ac.il)

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