

The Impact of Macromastia on Adolescents: A Cross-Sectional Study

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KEY WORDS

macromastia, adolescent, quality-of-life, self-esteem, eating disorder, reduction mammoplasty

ABBREVIATIONS

BRSQ—Breast-Related Symptoms Questionnaire

EAT-26—Eating Attitudes Test-26

HRQOL—health-related quality of life

RSES—Rosenberg Self-Esteem Scale

OR—odds ratio

SF-36—Short-Form 36v2

Dr Labow is the principal investigator and Drs DiVasta and Greene are co-investigators of this study. Drs Labow, DiVasta, and Greene made significant contributions to the conception and design, acquisition of data, interpretation of data, and revising the article; Dr Rosen and Ms Webb made substantial contributions to the conception and design of this study; Ms Cerrato, Ms Webb, Ms Nuzzi, and Ms McCarty made substantial contributions to the acquisition, analysis, and interpretation of data; Ms Cerrato drafted the article; Drs Labow, DiVasta, and Greene revised it for intellectual content; and all authors gave final approval of the version to be published. All authors have participated sufficiently in the work to take public responsibility for appropriate portions of the content.

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WHAT'S KNOWN ON THIS SUBJECT: Macromastia is associated with severe physical and emotional symptoms and negatively impacts health-related quality of life in adult women. Reduction mammoplasty is the most effective treatment for adults. Little is known regarding the impact of macromastia during adolescence.



WHAT THIS STUDY ADDS: Adolescents with macromastia have impaired health-related quality of life, lower self-esteem, more breast-related symptoms, and are at higher risk for disordered eating in comparison with their peers. These negative health outcomes have implications for early intervention in this patient population.

abstract

FREE

OBJECTIVE: To determine the physical and psychosocial impact of macromastia on adolescents considering reduction mammoplasty in comparison with healthy adolescents.

METHODS: The following surveys were administered to adolescents with macromastia and control subjects, aged 12 to 21 years: Short-Form 36v2, Rosenberg Self-Esteem Scale, Breast-Related Symptoms Questionnaire, and Eating-Attitudes Test-26 (EAT-26). Demographic variables and self-reported breast symptoms were compared between the 2 groups. Linear regression models, unadjusted and adjusted for BMI category (normal weight, overweight, obese), were fit to determine the effect of case status on survey score. Odds ratios for the risk of disordered eating behaviors (EAT-26 score ≥ 20) in cases versus controls were also determined.

RESULTS: Ninety-six subjects with macromastia and 103 control subjects participated in this study. Age was similar between groups, but subjects with macromastia had a higher BMI ($P = .02$). Adolescents with macromastia had lower Short-Form 36v2 domain, Rosenberg Self-Esteem Scale, and Breast-Related Symptoms Questionnaire scores and higher EAT-26 scores compared with controls. Macromastia was also associated with a higher risk of disordered eating behaviors. In almost all cases, the impact of macromastia was independent of BMI category.

CONCLUSIONS: Macromastia has a substantial negative impact on health-related quality of life, self-esteem, physical symptoms, and eating behaviors in adolescents with this condition. These observations were largely independent of BMI category. Health care providers should be aware of these important negative health outcomes that are associated with macromastia and consider early evaluation for adolescents with this condition. *Pediatrics* 2012;130:e339–e346

Macromastia (breast hypertrophy) is a common condition that negatively impacts the physical and mental health of adult women who have this disorder.^{1–14} Although macromastia often develops during adolescence,¹⁵ the impact of macromastia on overall health-related quality of life (HRQOL) in this age group is unknown. Reduction mammoplasty, surgical reduction of breast size, is the most effective means of improving symptoms and HRQOL in adults.^{2,4,6–8,13,14,16–25} However, many parents and physicians are reluctant to consider surgical correction for adolescents.^{26,27} Data on the impact of macromastia on younger patients are needed to better inform health care providers, patients, and families in making appropriate treatment decisions.

Retrospective data have shown that reasons for seeking reduction mammoplasty during adolescence included pain, poor self-esteem, and difficulty finding properly fitting clothes.²⁷ Women who underwent reduction mammoplasty as adolescents reported experiencing teasing, embarrassment, and low self-confidence preoperatively.²⁸

There is also evidence that younger women (<30 years old) are troubled by the psychosocial consequences of macromastia, including undesired attention and poor self-image.²⁹ Additionally, eating disorders may be associated with macromastia in young adults.^{18,30}

These limited retrospective studies suggest a considerable impact of macromastia on adolescents and imply that early intervention may alleviate physical and psychosocial symptoms. However, the burden of macromastia in a younger population has not been measured prospectively through validated testing methodologies. We aimed to determine the physical and psychosocial impact of macromastia on adolescent patients considering reduction mammoplasty in comparison with a control group.

METHODS

Subjects

Eligible subjects included adolescents and young women between the ages of 12 and 21 years who were diagnosed with bilateral macromastia by a plastic surgeon and had no history of breast surgery. Diagnosis was based on symptom profile, physical examination, and modified Shnur criteria.^{31,32} Subjects with macromastia were prospectively enrolled at the time of initial consultation through the Adolescent Breast Clinic at the Department of Plastic and Oral Surgery at Children's Hospital Boston from October 2008 through August 2011.

Concurrently, female controls in the same age range were prospectively enrolled at clinics within the Department of Plastic and Oral Surgery or the Division of Adolescent/Young Adult Medicine (a nonsurgical clinic) at the same institution. Control subjects were eligible if they reported a current state of good health with no significant past medical or surgical history (including diagnosis of an eating disorder or mental health issue), no diagnosis of a benign breast disorder, no breast complaint, and no previous treatment for a breast condition. Informed consent or assent was obtained from all subjects and a parent or guardian, as applicable. This study was approved by the Children's Hospital Boston Committee on Clinical Investigation.

Demographics and Clinical Presentation

Height and weight were obtained on all participants. BMI was calculated by dividing weight (kg) by height squared (m²). BMI-for-age percentiles for participants between ages less than 20 years old were calculated by using the Centers for Disease Control and Prevention Child and Teen BMI Calculator, which accounts for age and gender.³³ Participants were designated as normal-weighted

if BMI < 85th percentile for their age, overweight if BMI was between the 85th to 94th percentile for age, and obese if BMI ≥ 95th percentile for age. For participants aged 20 years or older, BMI category (normal-weighted, overweight, or obese) was determined by using the Centers for Disease Control and Prevention Adult BMI Calculator.³⁴ Because of the age range of our sample, we used BMI category as a covariate in subsequent analyses. Other relevant medical information, including self-reported breast symptoms, was obtained from medical records of subjects with macromastia.

Measures

Study subjects were asked to complete 4 self-administered surveys: the Short-Form 36v2 (SF-36), the Rosenberg Self-Esteem Scale (RSES), the Breast-Related Symptoms Questionnaire (BRSQ), and the Eating Attitudes Test-26 (EAT-26). Survey selection was based on a review of tools that had been previously used in adult macromastia research and in adolescent and young adult samples.^{1,4–6,10,11,18,25,30,35–42} Participants completed the surveys independently either in clinic or at home.

The SF-36 is a widely utilized 36-item measure that evaluates HRQOL in 8 domains: physical functioning, role-physical, bodily pain, general health, vitality, social functioning, role-emotional, and mental health.⁴³ Domain scores are transformed to a scale of 0 to 100; a higher SF-36 domain score is associated with a better HRQOL. We report transformed domain scores for case-control comparison.

The RSES is a 10-item scale designed to measure global self-esteem.⁴⁰ Respondents indicate if they strongly agree, agree, disagree, or strongly disagree with statements such as "On the whole, I am satisfied with myself." Scores range from 10 to 40; a higher score indicates better self-esteem.⁴⁴

The BRSQ is a 13-item survey designed to quantitate physical symptoms experienced by patients with macromastia. The respondent indicates how often she experiences each symptom, such as “I have breast pain” or “I have painful bra strap grooves,” ranging from all of the time to none of the time. A higher score corresponds to fewer, less severe symptoms.^{5,41}

The EAT-26 is a 26-item scale that assesses attitudes and behaviors regarding eating and body image. Respondents indicate how often they agree with statements such as “I find myself preoccupied with food” or “I engage in dieting behavior.” Scores of 20 and above are indicative of disordered eating.⁴² We conducted our analyses on mean EAT-26 score and whether or not subjects scored above this threshold.

In addition to these 4 questionnaires, control participants were asked to complete a short investigator-designed survey to determine if they had breast concerns unaddressed by a health care provider. Control participants were asked if they had ever considered breast surgery to increase or reduce breast size, to self-report bra size, and if they experienced breast-related symptoms such as back, neck, and shoulder pain, trouble participating in sports, and difficulty finding clothes that fit.

Data Management and Statistical Methods

Study data were collected and managed by using REDCap electronic data capture tools hosted at Children’s Hospital Boston (in conjunction with support from Harvard Catalyst). REDCap (Research Electronic Data Capture) is a secure, web-based application designed to support data capture for research studies, providing (1) an intuitive interface for validated data entry, (2) audit trails for tracking data manipulation and export procedures, (3) automated export procedures for seamless data

downloads to common statistical packages, and (4) procedures for importing data from external sources.⁴⁵

Statistical analyses were performed by using Stata 10.1 (College Station, TX). Demographics and clinical information were compared between groups by using independent 2-sample *t* test, Pearson χ^2 , or Fisher exact test as appropriate.

The scores for the SF-36 domains, RSES, BRSQ, and EAT-26 were generated according to algorithms provided by Ware et al,⁴⁶ Rosenberg,⁴⁰ Kerrigan et al,⁵ and Garner et al,⁴² respectively. Linear regression models were fit to determine the effect of macromastia on each SF-36 domain score and independent survey score (BRSQ, EAT-26, and RSES). Covariates of interest included age and BMI category; these were included in the models if a statistically significant difference was detected between subjects with macromastia and controls.

The relationship between macromastia and elevated EAT-26 score (≥ 20) was determined by χ^2 testing. Odds ratios (ORs) for the risk of an elevated EAT-26 score were determined by logistic regression. A *P* value of $<.05$ was considered statistically significant for all analyses.

RESULTS

Between October 2008 and August 2011, 96 patients with macromastia and 103 controls participated in this study. Neither mean age between the cases and controls (17.5 ± 1.8 years vs 17.8 ± 2.7 years) nor distribution of race/ethnicity differed (Table 1). Subjects with macromastia had a higher mean BMI than the control group (28.4 ± 6.2 kg/m² vs 26.3 ± 6.7 kg/m², *P* = .02). A greater proportion of control subjects were of normal weight (55%) than subjects with macromastia (29%) (*P* < .001; Table 1, Fig 1). Six (6%) subjects with macromastia indicated having been previously treated for an eating

disorder, and an additional 13 (14%) subjects had been previously treated for anxiety and/or depression. Thirty-four (35%) subjects with macromastia had a family history of general breast disorders, and 28 (29%) had a family history of breast cancer.

Participants with macromastia reported higher rates of breast pain, skin breakdown and rashes (intertrigo), perceived difference in breast size, difficulty participating in sports, difficulty finding clothes that fit, and associated back, neck, and shoulder pain (*P* < .001, Table 2). Age at thelarche did not differ between groups (*P* = .14). The most frequently reported cup size in the macromastia group was DD in contrast to B in the control group. Twenty (19%) control participants indicated they believed their breasts were too large for their bodies, and 13 (13%) would consider surgery to reduce breast size but had not pursued treatment.

Subjects with macromastia scored lower than control subjects in all SF-36 domains, the RSES, and the BRSQ, and higher on the EAT-26 (Table 3). Macromastia was a significant predictor of lower scores in each domain on the SF-36 (*P* < .05, Table 3), indicating that subjects with macromastia had a lower HRQOL in comparison with controls. Additionally, subjects with macromastia had lower self-esteem (RSES score *P* = .001), more severe breast-related symptoms (BRSQ *P* < .001), and more disordered eating behaviors (EAT-26 *P* = .02) in comparison with controls (Table 3). After adjusting for BMI category, differences in the SF-36 general health domain and EAT-26 scores were no longer significant between groups (Table 3; *P* > .05). However, mean scores of the remaining 7 SF-36 domains, RSES, and BRSQ remained significantly lower in subjects with macromastia than in controls (Table 3). We also compared the prevalence

TABLE 1 Demographic Variables Reported by Adolescents With Macromastia ($n = 96$) and Control Subjects ($n = 103$)

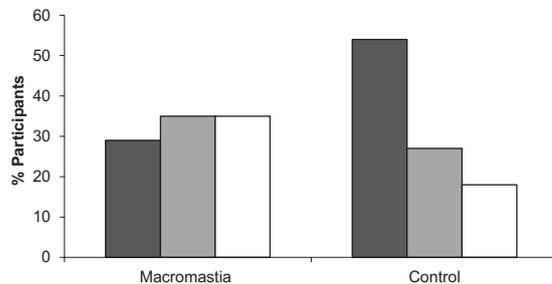
	Macromastia	Controls ^a	<i>P</i>
Age, $y \pm SD$ (range)	17.5 ± 1.8 (12.8–21.9)	17.8 ± 2.7 (12.2–21.8)	.27 ^b
BMI, $kg/m^2 \pm SD$ (range)	28.4 ± 6.2 (18.3–60.6)	26.3 ± 6.7 (16.1–46.3)	.02 ^b
BMI category, n (%)			.001 ^c
Normal	28 (29)	56 (54)	
Overweight	34 (35)	27 (27)	
Obese	34 (35)	19 (18)	
Race/ethnicity, n (%)			.21 ^d
White	51 (53)	41 (40)	
Black or African American	20 (21)	34 (33)	
Asian	0	1 (1)	
Hispanic	0	1 (1)	
Native American	1 (1)	0	
Other	10 (10)	11 (11)	
Declined to answer/NA	14 (15)	15 (15)	

^a Height and weight were not obtained for 1 control participant. Percentages for BMI category are out of $n = 102$.

^b Two-sided *P* value for independent *t* test;

^c Pearson χ^2 .

^d Fisher exact test.

**FIGURE 1**

Distribution of BMI category between study groups. Dark gray, normal weighted; light gray, overweight; white, obese.

of disordered eating thoughts and behaviors (defined as EAT-26 score ≥ 20) between groups. The prevalence of disordered eating was greater in the macromastia subjects ($n = 17$, 18%) than in controls ($n = 6$, 6%; $P = .009$). Subjects with macromastia demonstrated a 3.5 odds of reaching the cutoff for disordered eating in comparison with controls (95% confidence interval 1.3–9.2; $P = .01$). Adjusting for BMI category lessened this risk (OR = 3.0), but case status remained a significant determinant of reaching the EAT-26 cutoff score (95% confidence interval 1.1–8.2; $P = .03$).

DISCUSSION

Adolescents with macromastia report debilitating physical and emotional symptoms that are well known to

treating physicians but have not been assessed in a large, prospective study. In an effort to demonstrate the morbidity of macromastia during adolescence, 4 validated surveys previously used in patients with macromastia, adolescents, or both, were administered. Subjects with macromastia had negatively impacted HRQOL, lower self-esteem, more breast-related symptoms, and more disordered eating thoughts and behaviors than in a group of female controls. These data suggest that macromastia has a substantial negative impact in a younger population and have implications for early treatment recommendations.

Adult women with macromastia report severe breast-related symptoms such as back, neck, and shoulder pain, difficulty

exercising, and difficulty finding properly fitting clothes.^{1–5,7,9,14,16,18,23,47–49} It is not surprising that adolescents with macromastia in this study report similar concerns. Interestingly, control subjects reported a number of symptoms including back (17%), neck (10%), and shoulder pain (13%). Control participants had not presented to a provider for a breast-related issue. However, 13% of controls indicated at least some interest in pursuing surgery to decrease breast size; only 2 of these participants were obese. The unexpectedly high level of breast concerns may be related to selection bias, because adolescents with unreported yet underlying concerns for breast health may have been more interested in participating in this study. Although including these subjects in the control group decreases the observed difference in symptoms between groups, these differences remained significant. This observation also provides insight into the prevalence of breast-related symptoms in adolescents.

Obesity and macromastia are strongly associated; ~30% of adults with macromastia are obese.^{50–52} Our results confirm this observation with high rates of overweight (35%) and obesity (35%) in our subjects with macromastia. Thus, we controlled for BMI category. In all 8 domains of HRQOL covered in the SF-36, subjects with macromastia scored lower than control subjects. Our results correspond with findings in adult studies^{1,4,11,24,35,37} and suggest that macromastia negatively affects both the physical and mental aspects of a young woman's health. BMI category did not impact the effect of macromastia for 7 of 8 SF-36 domains. Thus, the effects of macromastia on HRQOL are not explained by weight alone. Adolescent patients with macromastia anecdotally report unwanted attention and embarrassment because of their large breasts. To date, no objective

TABLE 2 Self-reported Breast Symptoms in Adolescents With Macromastia ($n = 96$) Compared With Control Subjects ($n = 103$)

Symptoms	Macromastia	Controls	P^a
Breast pain	40 (42)	14 (14)	<.001
Significant difference in breast size	27 (28)	8 (8)	<.001
Skin breakdown or rashes around or beneath breasts	39 (42)	8 (8)	<.001
Difficulty participating in sports	71 (75)	12 (12)	<.001
Difficulty finding clothes that fit	85 (89)	23 (22)	<.001
Back pain	85 (89)	17 (17)	<.001
Neck pain	90 (94)	10 (10)	<.001
Shoulder pain	79 (82)	13 (13)	<.001

Values shown are number of patients, with percentage in parentheses.

^a Pearson χ^2 test.

TABLE 3 Linear Regression Models on the Effect of Macromastia on Mean Survey Score

	Macromastia ($n = 96$)	Controls ($n = 103$)	P^a	P^b
SF-36 domain, mean, SD				
Physical functioning	68.7 \pm 25.4	91.0 \pm 18.5	<.001	<.001
Role-physical	66.6 \pm 26.4	89.7 \pm 17.7	<.001	<.001
Bodily pain	49.5 \pm 21.3	72.5 \pm 19.4	<.001	<.001
General health	67.8 \pm 18.8	74.2 \pm 20.0	.02	.15
Vitality	40.1 \pm 16.7	49.4 \pm 15.8	<.001	.001
Social functioning	67.4 \pm 27.4	82.7 \pm 20.7	<.001	<.001
Role-emotional	73.4 \pm 27.5	85.9 \pm 19.6	<.001	.001
Mental health	64.0 \pm 20.1	72.8 \pm 18.5	.002	.01
RSES, mean, SD	29.9 \pm 5.4	33.2 \pm 5.7	<.001	<.001
BRSQ, mean, SD	36.4 \pm 18.4	92.8 \pm 10.9	<.001	<.001
EAT-26, mean, SD	10.7 \pm 11.0	7.5 \pm 7.8	.02	.13

P value for regression coefficient (β) for case status.

^a Unadjusted.

^b Adjusted for BMI category.

measurements to quantify these self-esteem issues have been published. Our subjects with macromastia demonstrated lower RSES scores than our controls. This finding suggests that patients with macromastia have lower self-esteem in comparison with their peers and parallels the negative mental health SF-36 domain scores. This result was similarly independent of BMI, indicating that negative self-esteem related to macromastia is due to the condition itself and is not simply a product of age or weight.

In addition to assessing self-reported symptoms, study participants completed the BRSQ. The differences observed between groups in self-reported symptoms imply that adolescents with macromastia experience more breast symptoms. Administration of the BRSQ to younger patients is novel and allows for standardized measurement of the

extent and severity of macromastia symptoms. Participants with macromastia scored significantly lower on the BRSQ than did control subjects, indicating more severe and numerous breast-related symptoms. This observation was independent of BMI category, suggesting that breast-related concerns are due to breast hypertrophy rather than to weight.

Macromastia is associated with eating disorders.^{30,53} In our study, subjects with macromastia had a higher risk of disordered eating (EAT-26 \geq 20) than controls independent of BMI category (OR = 3.0; $P = .03$). This observed 3-fold risk underscores the increased incidence of disordered eating behaviors in our patients with macromastia. Our study design precludes any conclusions about the cause of eating disorders in adolescent patients with macromastia. However, the negative

impact on self-esteem and body image may increase the risk of disordered eating behaviors in these patients. Health care providers should be aware of this association and assess adolescent patients with macromastia for patterns of disordered eating.

The observed impact on HRQOL, self-esteem, and eating behaviors in adolescents with macromastia may indicate that early intervention to alleviate breast symptoms may be warranted to improve these negative health outcomes. In adult women, reduction mammoplasty resolves breast-related symptoms and improves self-esteem, eating behaviors, and overall HRQOL.^{2,7,9,11,16–23} Alternatively, nonsurgical methods of macromastia treatment such as weight loss have been shown to be ineffective.⁴ Reduction mammoplasty, therefore, has become the standard of care for adult women with macromastia.

In contrast, treatment recommendations for adolescents with macromastia are limited. Health care providers and parents may be reluctant to offer reduction mammoplasty to adolescents for concerns of age, physical and psychological maturity, effect on future lactation, possible need for repeat surgery, effect on body image, or comorbidity with obesity.^{26,27} However, successful reduction mammoplasty outcomes have been observed in young patients.^{26,27,54,55} Adults who underwent mammoplasty as teenagers report high satisfaction levels throughout adulthood.^{27,28} Obesity status does not affect outcome or satisfaction,⁵⁴ suggesting that obesity should not be viewed as an absolute contraindication to surgery. Reduction mammoplasty may even serve as a motivating factor for further weight loss, in part, because of increased ability to exercise.^{9,56,57} However, whereas these studies and results of studies in adult women would imply overall postoperative improvement in a younger population as

well, the effect of reduction mammoplasty on the HRQOL, self-esteem, breast-related symptoms, and eating behaviors as measured by standardized questionnaires in adolescent patients remains unknown.

The results of the current study confirm results of aforementioned retrospective studies and the anecdotal accounts of decreased overall quality of life in adolescent patients with macromastia who present to our institution for reduction mammoplasty consult. Although no single set of treatment guidelines applies to all symptomatic macromastia patients, our clinic requires at least 2 detailed preoperative consultations with a pediatric plastic surgeon. Both patient and parent(s)/guardian(s) need to fully understand the risk and benefits of reduction mammoplasty and be in agreement before the patient undergoes surgery. A good candidate for surgery is at or near skeletal maturity, is a nonsmoker, reports severe and consistent symptoms, and has no physical health contraindications. History or presence of an eating disorder is assessed, and referrals to specialists are made as required. Counseling and support for weight loss in overweight and obese patients are provided. For obese patients considering weight loss, the potential negative aesthetic result of massive weight loss postreduction mammoplasty, as reported by others,⁵⁷ is discussed. Postoperatively, our patients

anecdotally report consistent symptom relief and presumably improved HRQOL, self-esteem, and eating attitudes. However, postoperative survey and outcomes data are needed to assess the efficacy of reduction mammoplasty in young patients and to contribute to evidence-based treatment guidelines.

Study limitations should be acknowledged. Differences existed in BMI between cases and controls; we thus controlled for BMI. There are no SF-36 normative values for adolescents as young as those included in our study; we thus used a control sample to compare scores. We allowed for 10% missing data in our analyses, which may have affected mean scores. The results of this study may not be generalizable because we recruited subjects from an urban pediatric tertiary care facility. The inclusion criteria of our control group were broad, and many of these subjects had some breast concerns. However, control subjects were recruited from clinics where providers routinely screen for benign breast disorders and refer patients for reduction mammoplasty consultation if necessary. Therefore, there were opportunities for potential participants to express breast-related concerns to a health care provider before consent. Nonetheless, differences in survey scores between groups suggest that subjects who identify as having macromastia and seek surgical treatment have an

impacted HRQOL above and beyond females who may have considered but have not yet pursued treatment for such issues.

CONCLUSIONS

There is a substantial negative impact on HRQOL, self-esteem, physical symptoms, and eating behaviors in adolescents and young adults with macromastia regardless of BMI. These results indicate important clinical considerations when treating younger patients and will contribute to the development of evidence-based treatment recommendations for macromastia in this age group. Health care providers should be aware of the emotional and physical impact of macromastia and consider early evaluation for this disorder.

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REFERENCES

1. Behmand RA, Tang DH, Smith DJ Jr. Outcomes in breast reduction surgery. *Ann Plast Surg.* 2000;45(6):575–580
2. Blomqvist L, Eriksson A, Brandberg Y. Reduction mammoplasty provides long-term improvement in health status and quality of life. *Plast Reconstr Surg.* 2000;106(5):991–997
3. Blomqvist L, Brandberg Y. Three-year follow-up on clinical symptoms and health-related quality of life after reduction mammoplasty. *Plast Reconstr Surg.* 2004;114(1):49–54
4. Collins ED, Kerrigan CL, Kim M, et al. The effectiveness of surgical and nonsurgical interventions in relieving the symptoms of macromastia. *Plast Reconstr Surg.* 2002;109(5):1556–1566
5. Kerrigan CL, Collins ED, Striplin D, et al. The health burden of breast hypertrophy. *Plast Reconstr Surg.* 2001;108(6):1591–1599
6. Thoma A, Sprague S, Veltri K, Duku E, Furlong W. A prospective study of patients undergoing breast reduction surgery: health-related quality of life and clinical outcomes. *Plast Reconstr Surg.* 2007;120(1):13–26
7. Chadbourne EB, Zhang S, Gordon MJ, et al. Clinical outcomes in reduction mammoplasty: a systematic review and meta-analysis of published studies. *Mayo Clin Proc.* 2001;76(5):503–510
8. Miller BJ, Morris SF, Sigurdson LL, et al. Prospective study of outcomes after reduction mammoplasty. *Plast Reconstr Surg.*

- 2005;115(4):1025–1031, discussion 1032–1033
9. O'Blenes CA, Delbridge CL, Miller BJ, Pantelis A, Morris SF. Prospective study of outcomes after reduction mammoplasty: long-term follow-up. *Plast Reconstr Surg*. 2006;117(2):351–358
 10. Shakespeare V, Cole RP. Measuring patient-based outcomes in a plastic surgery service: breast reduction surgical patients. *Br J Plast Surg*. 1997;50(4):242–248
 11. Faria FS, Guthrie E, Bradbury E, Brain AN. Psychosocial outcome and patient satisfaction following breast reduction surgery. *Br J Plast Surg*. 1999;52(6):448–452
 12. Atterhem H, Holmner S, Janson PE. Reduction mammoplasty: symptoms, complications, and late results. A retrospective study on 242 patients. *Scand J Plast Reconstr Surg Hand Surg*. 1998;32(3):281–286
 13. Brühlmann Y, Tschopp H. Breast reduction improves symptoms of macromastia and has a long-lasting effect. *Ann Plast Surg*. 1998;41(3):240–245
 14. Gonzalez F, Walton RL, Shafer B, Matory WE Jr, Borah GL. Reduction mammoplasty improves symptoms of macromastia. *Plast Reconstr Surg*. 1993;91(7):1270–1276
 15. Corriveau S, Jacobs JS. Macromastia in adolescence. *Clin Plast Surg*. 1990;17(1):151–160
 16. Boschert MT, Barone CM, Puckett CL. Outcome analysis of reduction mammoplasty. *Plast Reconstr Surg*. 1996;98(3):451–454
 17. Chao JD, Memmel HC, Redding JF, Egan L, Odom LC, Casas LA. Reduction mammoplasty is a functional operation, improving quality of life in symptomatic women: a prospective, single-center breast reduction outcome study. *Plast Reconstr Surg*. 2002;110(7):1644–1652, discussion 1653–1654
 18. Losee JE, Jiang S, Long DE, Kreipe RE, Caldwell EH, Serletti JM. Macromastia as an etiologic factor in bulimia nervosa: 10-year follow up after treatment with reduction mammoplasty. *Ann Plast Surg*. 2004;52(5):452–457, discussion 457
 19. Eggert E, Schuss R, Edsander-Nord A. Clinical outcome, quality of life, patients' satisfaction, and aesthetic results, after reduction mammoplasty. *Scand J Plast Reconstr Surg Hand Surg*. 2009;43(4):201–206
 20. Saariemi KM, Keranen UH, Salminen-Peltola PK, Kuokkanen HO. Reduction mammoplasty is effective treatment according to two quality of life instruments. A prospective randomised clinical trial. *J Plast Reconstr Aesthet Surg*. 2008;61(12):1472–1478
 21. Saariemi KM, Joukamaa M, Raitasalo R, Kuokkanen HO. Breast reduction alleviates depression and anxiety and restores self-esteem: a prospective randomised clinical trial. *Scand J Plast Reconstr Surg Hand Surg*. 2009;43(6):320–324
 22. Singh KA, Losken A. Additional benefits to reduction mammoplasty: a systemic review of the literature. *Plast Reconstr Surg*. 2012;129(3):562–570
 23. Glatt BS, Sarwer DB, O'Hara DE, Hamori C, Bucky LP, LaRossa D. A retrospective study of changes in physical symptoms and body image after reduction mammoplasty. *Plast Reconstr Surg*. 1999;103(1):76–82, discussion 83–85
 24. Iwuagwu OC, Walker LG, Stanley PW, Hart NB, Platt AJ, Drew PJ. Randomized clinical trial examining psychosocial and quality of life benefits of bilateral breast reduction surgery. *Br J Surg*. 2006;93(3):291–294
 25. Sabino Neto M, Demattê MF, Freire M, Garcia EB, Quaresma M, Ferreira LM. Self-esteem and functional capacity outcomes following reduction mammoplasty. *Aesthet Surg J*. 2008;28(4):417–420
 26. Evans GR, Ryan JJ. Reduction mammoplasty for the teenage patient: a critical analysis. *Aesthetic Plast Surg*. 1994;18(3):291–297
 27. Lee MC, Lehman JA Jr, Tantri MD, Parker MG, Wagner DS. Bilateral reduction mammoplasty in an adolescent population: adolescent bilateral reduction mammoplasty. *J Craniofac Surg*. 2003;14(5):691–695
 28. McMahan JD, Wolfe JA, Cromer BA, Ruberg RL. Lasting success in teenage reduction mammoplasty. *Ann Plast Surg*. 1995;35(3):227–231
 29. Sigurdson L, Mykhalovskiy E, Kirkland SA, Pallen A. Symptoms and related severity experienced by women with breast hypertrophy. *Plast Reconstr Surg*. 2007;119(2):481–486
 30. Losee JE, Serletti JM, Kreipe RE, Caldwell EH. Reduction mammoplasty in patients with bulimia nervosa. *Ann Plast Surg*. 1997;39(5):443–446
 31. Schnur PL, Hoehn JG, Ilstrup DM, Cahoy MJ, Chu CP. Reduction mammoplasty: cosmetic or reconstructive procedure? *Ann Plast Surg*. 1991;27(3):232–237
 32. Schnur PL. Reduction mammoplasty—the schnur sliding scale revisited. *Ann Plast Surg*. 1999;42(1):107–108
 33. Centers for Disease Control and Prevention. BMI Percentile Calculator for Child and Teen. Available at: <http://apps.nccd.cdc.gov/dnpabmi>. Accessed July 11, 2011
 34. Centers for Disease Control and Prevention. Adult BMI Calculator. Available at: http://www.cdc.gov/healthyweight/assessing/bmi/adult_bmi/english_bmi_calculator/bmi_calculator.html. Accessed July 11, 2011
 35. Kerrigan CL, Collins ED, Kneeland TS, et al. Measuring health state preferences in women with breast hypertrophy. *Plast Reconstr Surg*. 2000;106(2):280–288
 36. Iwuagwu OC, Platt AJ, Stanley PW, Hart NB, Drew PJ. Does reduction mammoplasty improve lung function test in women with macromastia? Results of a randomized controlled trial. *Plast Reconstr Surg*. 2006;118(1):1–6, discussion 7
 37. Mello AA, Domingos NA, Miyazaki MC. Improvement in quality of life and self-esteem after breast reduction surgery. *Aesthetic Plast Surg*. 2010;34(1):59–64
 38. Goodman E, Amick BC, Rezendes MO, Tarlov AR, Rogers WH, Kagan J. Influences of gender and social class on adolescents' perceptions of health. *Arch Pediatr Adolesc Med*. 1997;151(9):899–904
 39. Greeson JM, Rosenzweig S, Halbert SC, Cantor IS, Keener MT, Brainard GC. Integrative medicine research at an academic medical center: patient characteristics and health-related quality-of-life outcomes. *J Altern Complement Med*. 2008;14(6):763–767
 40. Rosenberg M. *Society and the Adolescent Self-Image*. Princeton, NJ: Princeton University Press; 1965:326
 41. Pusic AL, Chen CM, Cano S, et al. Measuring quality of life in cosmetic and reconstructive breast surgery: a systematic review of patient-reported outcomes instruments. *Plast Reconstr Surg*. 2007;120(4):823–837, discussion 838–839
 42. Garner DM, Olmsted MP, Bohr Y, Garfinkel PE. The eating attitudes test: psychometric features and clinical correlates. *Psychol Med*. 1982;12(4):871–878
 43. Ware JE Jr. SF-36 health survey update. *Spine (Phila Pa 1976)*. 2000;25(24):3130–3139
 44. Poston WSC, Goodrick GK, Foreyt JP. The Rosenberg Self-Esteem Scale. In: St. Jeor ST, ed. *Obesity Assessment: Tools, Methods, Interpretations: A Reference Case: The RENO Diet-Heart Study*, Chapter 35. New York, NY: International Thomson Publishing; 1997:425
 45. Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG. Research electronic data capture (REDCap)—a metadata-driven methodology and workflow process for providing translational research informatics support. *J Biomed Inform*. 2009;42(2):377–381
 46. Ware JE Jr, Kosinski M, Bjorner JB, Turner-Bowker DM, Gandek B, Maruish ME. *User's Manual for the SF-36v2TM Health Survey*, 2nd ed. Lincoln, RI: QualityMetric Incorporated; 2007

47. Dabbah A, Lehman JA Jr, Parker MG, Tantri D, Wagner DS. Reduction mammoplasty: an outcome analysis. *Ann Plast Surg.* 1995;35(4):337–341
48. Netscher DT, Meade RA, Goodman CM, Brehm BJ, Friedman JD, Thornby J. Physical and psychosocial symptoms among 88 volunteer subjects compared with patients seeking plastic surgery procedures to the breast. *Plast Reconstr Surg.* 2000;105(7):2366–2373
49. Spector JA, Karp NS. Reduction mammoplasty: a significant improvement at any size. *Plast Reconstr Surg.* 2007;120(4):845–850
50. Cruz-Korchin N, Korchin L, González-Keelan C, Climent C, Morales I. Macromastia: how much of it is fat? *Plast Reconstr Surg.* 2002;109(1):64–68
51. Wagner DS, Alfonso DR. The influence of obesity and volume of resection on success in reduction mammoplasty: an outcomes study. *Plast Reconstr Surg.* 2005;115(4):1034–1038
52. Atisha DM, Alderman AK, Kuhn LE, Wilkins EG. The impact of obesity on patient satisfaction with breast reconstruction. *Plast Reconstr Surg.* 2008;121(6):1893–1899
53. Kreipe RE, Lewand AG, Dukarm CP, Caldwell EH. Outcome for patients with bulimia and breast hypertrophy after reduction mammoplasty. *Arch Pediatr Adolesc Med.* 1997;151(2):176–180
54. Webb ML, Cerrato F, Rosen H, Divasta AD, Greene AK, Labow BI. The effect of obesity on early outcomes in adolescents undergoing reduction mammoplasty. *Ann Plast Surg.* 2012;68(3):257–260
55. Koltz PF, Sbitany H, Myers RP, Shaw RB, Patel N, Giroto JA. Reduction mammoplasty in the adolescent female: the URM C experience. *Int J Surg.* 2011;9(3):229–232
56. Singh KA, Pinell XA, Losken A. Is reduction mammoplasty a stimulus for weight loss and improved quality of life? *Ann Plast Surg.* 2010;64(5):585–587
57. Coriddi M, Koltz PF, Gusenoff JA. Reduction mammoplasty, obesity, and massive weight loss: temporal relationships of satisfaction with breast contour. *Plast Reconstr Surg.* 2011;128(3):643–650

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