

Accuracy of Predicted Resection Weights in Breast Reduction Surgery

Theodore A. Kung, MD
Raouf Ahmed, MBBS
Christine O. Kang, MPH
Paul S. Cederna, MD
Jeffrey H. Kozlow, MD

Background: Many insurance carriers continue to deny coverage for reduction mammoplasty unless a minimum amount of resected breast tissue per breast is achieved during surgery. This study investigates the accuracy of preoperative prediction that a minimum weight of 500 g can be resected and evaluates potential risk factors for not meeting this insurance requirement.

Methods: A retrospective review was performed on 445 patients with bilateral symptomatic macromastia who sought consultation for breast reduction surgery from 2007 to 2012. Women were included for analysis if they had documented predicted resection weights and underwent small-to-moderate breast reduction (< 1,000 g per side; n = 323). Relevant demographic information, mean predicted resection weight, and the mean actual resection weight were collected for analysis.

Results: Surgeon prediction of resection weight being over 500 g had a positive predictive value of 73%. In 61 patients (19%), the predicted weights were \geq 500 g, but the actual weights were < 500 g. Thirty percentage of these 61 patients did not meet either Schnur or minimum weight requirements. Women with a body mass index < 30 were at significantly increased odds (odds ratio, 3.76; 95% confidence interval, 1.89–7.48; $P = 0.002$) of not meeting the minimum weight requirement at surgery compared with patients with a body mass index \geq 30.

Conclusions: The common insurance criterion of removing \geq 500 g per breast during breast reduction surgery are not met in a distinct cohort of women who are clinically appropriate candidates. This risk is particularly increased in non-obese women possibly due to proportionately smaller breast mass compared with obese women. (*Plast Reconstr Surg Glob Open* 2018;6:e1830; doi: 10.1097/GOX.0000000000001830; Published online 19 June 2018.)

INTRODUCTION

The physical and psychological benefits of reduction mammoplasty are well documented in the literature and summarized by clinical practice guidelines developed by The American Society of Plastic Surgeons.¹ Alleviation of symptoms relating to macromastia and improvement in quality of life can be reliably achieved in appropriate patients who have been selected based upon specific clinical criteria.^{2–6} Furthermore, it has been shown that the positive effects of breast reduction are experienced by patients regardless of the actual amount breast tissue resected during surgery.^{7,8} These findings have led to a shift away from

using standardized methods such as the Schnur sliding scale⁹ or the Seitchik formula¹⁰ to determine the medical necessity of reduction mammoplasty in favor of a more individualized evaluation of specific symptoms.

Despite this evidence-based focus on the clinical sequelae of macromastia among plastic surgeons, many insurance carriers still uphold policies that require patients to meet specific criteria before approving coverage for reduction mammoplasty.¹¹ One of the most common requirements is a minimum resection weight from each breast.¹² Companies that conduct prior authorization stipulate that a predicted resection weight per breast is submitted by the surgeon after the initial consultation visit before provisional approval is granted. Frequently, an arbitrary minimum resection weight of 500 g per breast is used by many carriers, irrespective of other salient patient factors such as body habitus and aesthetic proportions (Fig. 1). However, there is a real possibility that during breast reduction surgery, this minimum weight of resection per breast cannot be met, placing the patient at financial risk if the insurance carrier rescinds coverage ex postfacto.

From Michigan Medicine, Department of Surgery, Section of Plastic and Reconstructive Surgery, Ann Arbor, Mich.

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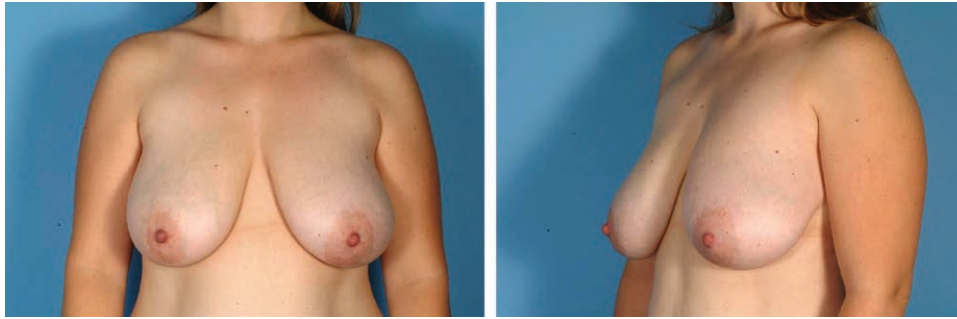


Fig. 1. A patient with bilateral symptomatic macromastia and a BMI of 27 seeking reduction mammoplasty. In many patients who are clinically appropriate candidates for small-to-moderate reduction mammoplasty based on symptoms, it is often difficult to accurately predict preoperatively that an arbitrary resection weight of 500 g per breast can be achieved during the operation. If 500 g cannot be resected intraoperatively, the surgeon faces the difficult decision to either complete the surgery and place the patient at financial risk or perform additional resection, which may compromise the aesthetic result.

At our institution, a predicted weight of resection per breast is routinely recorded by the plastic surgeon at the time of consultation, and this information, along with documentation of relevant symptoms, previous interventions, and photographs, is sent to the insurance company for prior authorization. The actual weight of resected breast tissue from each side is then documented intraoperatively and dictated into the medical record. This study examines how accurate plastic surgeons are at predicting if the actual resection weight will meet or surpass the commonly required minimum of 500 g. In addition, we attempt to identify any risk factors that may predispose to removal of less than 500 g when the predicted weight was \geq 500 g.

METHODS

Institutional review board approval was obtained for this retrospective review. All adult patients (> 18 year old) who sought consultation with 9 plastic surgeons at the University of Michigan for symptomatic macromastia from 2007 to 2012 were identified by searching the electronic medical records for the single International Classification of Disease diagnosis code for hypertrophy of breast (611.1). Patients who subsequently underwent bilateral breast reduction surgery were considered study candidates if both predicted minimum resection weights and actual resection weights were documented in the medical records. Exclusion criteria included male sex, previous reduction mammoplasty, unilateral surgery for breast asymmetry, and reduction mammoplasty relating to either breast cancer or transgender surgery. It was presumed that women with profound macromastia would certainly meet the commonly cited minimum resection weight of 500 g per breast used by many insurance carriers. Therefore, to focus our analysis specifically on those patients in whom a discrepancy between estimated resection weight and actual resection weight was more likely, we excluded women whose average actual resection weight was $\geq 1,000$ g. Thus, only women with small-to-moderate breast reductions with average actual resection weights of $< 1,000$ g were included in the final analysis.

Medical records consisting of consultation, operative, and postoperative notes were reviewed for patients

included in the study. Relevant demographic information such as patient age, race, body mass index (BMI), and insurance type (stratified as Medicare, Medicaid, or private) were recorded. Body surface area was calculated to determine if patients would meet criteria based upon the Schnur sliding scale.⁹ Additionally, the use of either an inferior pedicle versus a noninferior pedicle (includes superior, superomedial, medial, and central techniques) was documented.

Bivariate analysis was used to identify specific demographic factors that may contribute to inaccurate estimation of resected breast tissue. Subsequently, a multivariate logistic regression analysis was performed with adjustments for several relevant demographic variables to determine if any of these factors predispose to having a resection weight that is less than the preoperative predicted weight. Calculations were performed using SPSS 20.0 (SPSS, Inc., Chicago, Ill.) with $P < 0.05$ considered statistically significant.

RESULTS

A total of 708 women underwent bilateral breast reduction for symptomatic macromastia during the 6-year study period. Of these, 445 patients had both predicted minimum resection weights and actual resection weights documented in the medical records. There were 323 women in this group who underwent small to moderate ($< 1,000$ g) reduction mammoplasty operations (Table 1). In 167 of these women (52%), the surgeon correctly predicted that the mean resection weight would be greater or equal to 500 g (Table 2). On the other hand, in 61 women (19%), the surgeon predicted a mean resection weight of ≥ 500 g, but the actual resection weight was in fact < 500 g. Thus, the positive predictive value of the surgeons' clinical judgment at consultation was 73%. When surgeons predicted a resection weight of < 500 g, they were correct 77% of the time (negative predictive value).

To identify the risk factors that might lead to inaccurate estimation of resection weight at the time of consultation, multivariate logistic regression was carried out with adjustments for demographic variables that were found to be significant on bivariate analysis: BMI, race, insurance

Table 1. Patient Demographics of the Small to Moderate (< 1,000 g) Reduction Group

Variable	n = 323
Mean age (y)	40.7 ± 12.5
Mean resection weight (g)	852 (range, 78–4,168)
Insurance type, n (%)	
Private	271 (84)
Medicare	7 (2)
Medicaid	32 (10)
Other	13 (4)
BMI, n (%)	
< 30	129 (40)
≥ 30	194 (60)
Pedicle technique, n (%)	
Inferior	210 (65)
Noninferior	103 (32)
Other	10 (3)

Table 2. Rates of Correct and Incorrect Prediction for Small to Moderate (< 1000 g) Reductions (n = 323)

	Actual Intraoperative Weight		
	≥ 500 g	< 500 g	
Predicted Preoperative Weight ≥ 500 g	n = 167 (52%)	n = 61 (19%)	PPV, 73%
Predicted Preoperative Weight < 500 g	n = 22 (7%)	n = 73 (22%)	NPV, 77%

NPV, negative predictive value; PPV, positive predictive value.

Table 3. Potential Risk Factors Contributing to Inaccurate Prediction

Variable	OR	95% CI	P
BMI			
< 30 versus ≥ 30	4.51	2.30–8.82	0.002
Insurance type			
Medicare versus private	0.65	0.13–3.20	> 0.05
Medicaid versus private	0.37	0.05–3.11	> 0.05
Race			
White versus Non-White	4.13	0.94–18.29	> 0.05
Pedicle technique			
Noninferior versus Inferior	1.56	0.83–2.95	> 0.05

CI, confidence interval; OR, odds ratio.

type, and pedicle technique (Table 3). The analysis revealed that compared with patients with a BMI of greater or equal to 30, women with a BMI of less than 30 resulted in a significantly increased odds (odds ratio, 3.76; 95% confidence interval, 1.89–7.48; $P = 0.002$) of the surgeon predicting a resection weight of greater or equal to 500 g but then removing less than 500 g. Race, insurance type, and pedicle technique did not significantly affect the odds of resecting less than the minimum weight of 500 g.

Further examination was performed on the 61 patients whose resection weights were less than 500 g despite having predicted weights of ≥ 500 g. Among these women, only 18 (30%) would have met insurance criteria based upon the Schnur sliding scale. Therefore, 70% of these patients (43/61) did not have what many insurance companies consider medically necessary breast reductions based on both of these 2 commonly used insurance minimums. Billing information for these 43 patients was obtained to determine the financial outcome after surgery. In 40 pa-

tients (93%), reduction mammoplasty was still covered by the insurance carrier postoperatively. In the other 3 cases, coverage was denied postoperatively on the grounds of lack of medical necessity; however, in these cases, appeals were submitted and led to subsequent insurance approval.

DISCUSSION

Despite ample evidence that breast reduction surgery significantly alleviates the symptoms of macromastia^{13–16} and that postoperative relief is experienced regardless of the total weight of resected breast tissue,^{7,17} many insurance companies continue to mandate a minimum resection weight of 500 g per breast before granting coverage of the operation.¹² During the initial consultation visit, surgeons routinely estimate the amount of tissue to be resected, and this information is sent to the insurance carrier for prior authorization. However, this study demonstrates that the positive predictive value of surgeon prediction for women who need small-to-moderate breast reductions is 73% and that surgeon accuracy in predicting a resection weight equal to or greater than 500 g is only 52%. In nearly 20% of the patients in this series, the surgeon incorrectly estimated that at least 500 g would be resected, but subsequently the actual resection weight was less than 500 g. Such a discrepancy between the predicted and actual resection weights is a critical factor that may jeopardize insurance coverage of medically necessary breast reduction surgery and can potentially result in the patient being responsible for the costs of the operation. Although review of financial records indicates that all 43 patients in our study who did not meet both the 500 g minimum or the Schnur criteria ultimately obtained insurance approval, 3 patients did experience postoperative denial of coverage and needed to undergo an appeal process. This relatively low rate of denial could be attributed to the fact that insurance policies vary widely, and the postoperative audit protocols of each company is unknown; some may call for an obligatory report of the actual resection weight and other may not. Furthermore, regional differences in coverage for reduction mammoplasty may exist and other plastic surgeons may experience a higher rate of insurance denials for patients with symptomatic macromastia. Given the considerable chance of overestimating, the requirement of a minimum resection weight promotes a discriminatory practice against the proportion of women with symptomatic macromastia who are legitimate candidates for small-to-moderate breast reductions deemed necessary by well-established clinical criteria.

Understandably, insurance companies need to maintain policies that differentiate women suffering from symptomatic breast hypertrophy from patients with breast ptosis interested in a cosmetic operation. However, the existing criteria currently being used to determine medical necessity are flawed and not supported by rigorous investigation. For example, the familiar Schnur sliding scale was devised as a nomogram that relates resected breast weight to body surface area and defines surgeries resulting in resection weights above the 22nd percentile as being reconstructive, whereas those below the fifth percentile as cosmetic. Women whose resection weights fall between these 2 limits are thought to have combined reconstructive

tive and cosmetic needs requiring individualized consideration.⁹ However, serious methodological shortcomings in the study have been cited¹¹; most notably, the study involved surveys eliciting the perception of patients' motivations for surgery and therefore possessed significant biases. Additionally, there has been subsequent widespread misuse of the Schnur sliding scale by various third-party payers, and insurance policies have distorted the scope of the original study's conclusions.¹⁸

Despite these known limitations and a paucity of evidence that substantiates a factual relationship between resection weight and medical necessity, both the Schnur sliding scale and the arbitrary 500g minimum weight requirement remain in use by many insurance companies.^{11,12} Even when both of these weak metrics are applied, one can still expect that a subset of women with symptomatic breast hypertrophy may not qualify for insurance coverage. This point is highlighted in our study by the subset of women in whom the predicted resection weight was ≥ 500 g, but the actual resection weight was < 500 g. Of these 61 patients, only 18 would have qualified based on the Schnur sliding scale; the other 43 patients (70%) did not meet either criterion. Although this study did not specifically examine how likely actual resection weight met or surpassed a requisite resection weight based on the Schnur sliding scale, findings from this investigation are still relevant because even when insurance companies use a version of the Schnur sliding scale, a surgeon's predicted resection weight is still submitted for prior authorization. In fact, it is probably even more difficult to accurately predict whether an individual patient's actual resection weight will meet a given Schnur criterion than if a "greater than 500 grams" approach is used.

The continued use of these unfounded weight-based criteria is in sharp contrast to published data supporting a new definition of medical necessity that is derived from reported clinical symptoms. Kerrigan et al.⁶ conducted a study that examined patient-reported outcomes after reduction mammoplasty and demonstrated that existing criteria used for insurance prior authorization (either the Schnur sliding scale or the 500g minimum) do not predict if patients will benefit from surgery and therefore are unhelpful in determining medical necessity. The authors then examined 7 commonly reported physical symptoms (upper back pain, rashes, bra strap grooves, neck pain, shoulder pain, numbness, and arm pain) and concluded that significantly higher improvement scores could be achieved through surgery if ≥ 2 of the 7 physical symptoms were present all or most of the time. Our study provides additional rationale to abandon the use of arbitrary numerical cutoffs during the evaluation of symptomatic macromastia due to a considerable likelihood that the surgeon's predicted resection weight used to obtain prior authorization may be inaccurate, especially in women where small-to-moderate breast reductions would be performed.

To focus attention on the proportion of women who would most likely be affected by an inaccurate preoperative prediction that at least 500g per breast will be removed, patients who had $\geq 1,000$ g removed were excluded from analysis. We defined small-to-moderate breast reduc-

tions as removal of $< 1,000$ g per breast. Although other authors have used variable definitions of small, moderate, and large breast reductions, it is clear that the likelihood of resecting the 500g minimum required weight increases with the patient's body habitus. Sommer et al.¹⁹ examined a series of 263 women who underwent reduction mammoplasty and used the sternal notch-to-nipple measurement to help predict the weight of breast tissue from each side that would be removed in the operating room. The authors reported that shorter notch-to-nipple measurements from women with smaller body frames resulted in a lower percentage of patients in whom the specimen weight was at least 500g per breast. This is consistent with our study results, which demonstrate that a BMI of less than 30 (nonobese) significantly increases the odds of incorrectly predicting an actual resection weight of ≥ 500 g. Consequently, the minimum resection requirement of 500g per breast imposed by many insurance companies is especially perilous in these women.

A majority of the breast reductions in this study were performed using the inferior pedicle technique; to maximize the power of our analysis, reductions using superior, superomedial, medial, and central techniques were considered together as noninferior pedicle cases. Historically, concerns regarding the vascular supply to the nipple-areola complex with use of noninferior pedicles led many plastic surgeons to avoid these techniques in larger breast reductions.²⁰⁻²³ Although a growing body of evidence now suggests that these pedicle types can be safely used even for large reductions,²⁴⁻²⁷ we believed that the plastic surgeons in our study remained cautious of overresecting breast tissue when utilizing a noninferior pedicle technique. Moreover, these surgeons may have employed noninferior pedicle techniques only when they expected to perform small-to-moderate breast reductions. Logically, this would imply that noninferior pedicle techniques were more frequently involved in cases where the surgeon preoperatively predicts a resection weight of ≥ 500 g but subsequently resects < 500 g per breast. However, somewhat surprisingly, pedicle technique was not associated with such a discrepancy between predicted and actual breast weight. Possibly, this finding can be attributed to a lack of sufficient power required to elucidate the effect of pedicle technique.

One important assumption of this study is that all included patients underwent a medically necessary operation for functional reasons. Although all study patients were clinically diagnosed with symptomatic macromastia based upon history, it is conceivable that some patients were in fact seeking cosmetic surgery and unscrupulously reported a litany of key complaints (ie, back pain, shoulder pain, shoulder grooving, rashes, and so on). This assumption, however, does not affect the implication of our findings that preoperative prediction of resection weight can be quite inaccurate and may lead to rejection of coverage after surgery in patients with true symptomatic macromastia. Another limitation of this study is that it lacked sufficient power to conduct more extensive subgroup analysis. Although 708 breast reduction patients were initially identified, only 62% of these women could be included for further analysis due to incomplete docu-

mentation of either predicted minimum resection weights or actual resection weights. This may have limited our ability to ascertain other significant factors that influence the ability to predict whether or not a minimum weight of resection can be met. For example, physician experience has been cited as an important factor in making accurate weight estimations during the evaluation of macromastia.¹⁹ Of the 9 plastic surgeons in our study, 6 had ≥ 5 years of faculty experience during the study period, and the cases of 4 surgeons accounted for 85% of the total number of identified patients who underwent breast reduction. A larger study population would have permitted meaningful investigation of important variables such as variations in surgeon experience, a learning curve effect during the study period, or changes in surgical techniques.

CONCLUSIONS

Recent policy recommendations from the American Society of Plastic Surgeons state that the resection volume in reduction mammoplasty does not correlate with relief of symptoms of macromastia, and therefore, patient evaluation should focus on clinical presentation. The available evidence indicates that women who undergo small-to-moderate breast reductions for macromastia experience symptomatic relief, yet an arbitrary minimum resection weight of 500 g per breast is still a widely used criterion by many insurance companies. This study reveals that preoperative surgeon prediction of attaining the minimum resection weight can be quite inaccurate and could place these women at risk of having financial coverage rescinded after the operation. The authors conclude that the submission of predicted resection weight is an unnecessary step in the evaluation of symptomatic macromastia and may contribute to the unjustified denial of insurance coverage of a functional operation in clinically appropriate patients.

Theodore A. Kung, MD

1500 East Medical Center Drive
2130 Taubman Center
SPC 5340
Ann Arbor, MI 48109
E-mail: thekung@umich.edu

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