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A body mass index related scale for reconstructive breast reduction

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Abstract Breast reduction is a highly emotional topic, involving three conflicting interests: (a) women suffering from symptomatic macromastia, (b) health insurance companies, and (c) surgeons. Many insurance companies, including those in Austria, cover (if at all) only breast reductions with a minimum resection weight of 500 g per breast, irrespective of the physical build of the woman involved. We retrospectively reviewed 136 patients' charts from both cosmetic and reconstructive breast reduction operations and compared the breast resection weight to various parameters of body proportions such as height, weight, body mass index (BMI), and body surface area to determine the parameter best correlated to the weight of breast tissue resected. From this we developed a graded scale for guiding future operations irrespective of a woman's body build. The resection weight ranged from 55 to 1530 g (mean 450±266, median 406); mean BMI was 25.1. The arbitrary 500 g breast resection rule discriminates against women of nonaverage weight or height: of 24 patients (18%) with a cosmetic indication 4 had more than 500 g breast tissue resected bilaterally, while in 62 reconstructive patients (46%) less than the arbitrary 500 g breast tissue was resected. The parameter best correlated to the mean weight of breast tissue resected (sum of both breasts) was BMI. We therefore suggest using the BMI as the basis for a graded weight resection guideline for reconstructive breast reductions. The BMI-based scale treats equally women of all types of body build. In women with a BMI greater than 30 (classified as adiposity) we recommend that breast reduction be postponed, and a general body weight reduction program be undertaken for the sake of a higher impact on general well-being.

Keywords Breast reduction · Body mass index · Breast related pain syndrome · Insurance coverage

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Introduction

Breast reduction is the most common operation on the female breast in plastic surgery, with a rate of up to 9.5 in 100,000 women [12]. The amount of breast tissue removed varies widely and ranges from 30 g to 4 000 g or more per breast [14]. There is general agreement that hypertrophied breasts, in which the weight of the resected tissue reaches up to 4000 g, is a highly pathological condition; doubtless such reduction operations have a medically indicated, predominantly reconstructive character and should be covered by insurance companies. The medical indication is less clear when breast hypertrophy is less pronounced. Strombeck [19], in a survey of 1,220 women, defined breast hypertrophy, or macromastia, as a 50% increase in the proposed normal size of a breast of 400 g. Other authors [2, 10] use as a practical rule of thumb the borderline between normal and hypertrophied breasts as a bra cup size of D. Yet the definition of breast hypertrophy has always been somewhat vague since it cannot be considered as an absolute size or number, independently of body proportions.

Another ill-defined term is macromastia, which was initially used synonymously with the term breast hypertrophy (i.e., to denote a breast weighing 600 g or more [19]) but is now used mainly to differentiate between hypertrophied breasts and "normal large breasts." Macromastia in this definition is characterized by the presence of persistent, painful, physical breast-related symptoms, irrespective of absolute breast size, age, body weight,

and height [6]. Dabbah et al. [4] in contrast, use the term macromastia to describe breasts which the patient feels to be too large for her physical proportions, thus causing physical and/or emotional disturbances, and in which case a reduction would provide functional relief regardless of the amount of breast tissue removed. Breast-related symptoms include a broad variety of complaints such as breast pain, chest pain, shoulder pain, upper and lower back and neck strain, shoulder grooving, headache, arm pain, ulnar paresthesia, and intertrigo; the symptoms can be present alone or in combination [10]. Other psychological, social, and cosmetic complaints are poor posture, inability to participate in physical activities, fatigue, breast sagging (91% [6]), poorly fitting clothes, unacceptable appearance, feeling of deformity, and lowered self-esteem.

In the majority of recent studies [2, 4, 6, 9, 13] there is general agreement that symptomatic macromastia produces a physical and psychological burden, and that breast reduction leads to both a significant reduction in pain symptoms and a very high satisfaction rate. Additionally, psychological studies have demonstrated improvement in self-esteem and self-confidence. In a retrospective study on 406 patients [6] the primary reason for breast reduction (80% with more than 800 g tissue removed per breast) was the relief of breast-related symptoms (91%), followed by feelings of self-consciousness due to the size of their breasts (78%), and cosmetic concern (65%). No woman listed cosmetic concern alone as her primary motivation. In either case, whether the operation is primarily reconstructive or cosmetic, there are valid reasons for plastic surgeons to perform breast reductions.

From the point of view of insurance companies, however, this differentiation is the key point in their decision whether to reimburse the costs of the operation, as most of them exclude cosmetic procedures in their contracts. The differentiation between purely esthetic and reconstructive indications is, especially at or below a resection weight of 500 g per breast, unclear, and decisions are necessarily somewhat arbitrary since "true motivations" are difficult or impossible to quantify in a scientific way. Apart from those insurance companies that do not cover the procedures at all, there are companies that define predicted specimen weights under 700 g on each side as "purely" esthetic cases [8] and others that demand documented radiographic confirmation of skeletal problems stemming from large breasts [16]. Most companies (including those in Austria) reimburse the cost of a resection involving more than 500 g tissue per breast, provided that the patient is not more than 10% above ideal body weight or adipose. Schnur et al. [16] attempted to determine more measurable criteria and to establish an algorithm to differentiate between cosmetic and reconstructive breast reductions. They plotted the logarithm of the tissue weight removed from the right breast against the body surface area (n=600), and declared (on the basis of the opinion of 132 plastic surgeons) operations below the 5th percentile to be purely cosmetic and those above the 22nd percentile to be reconstructive.

Despite this and other attempts to define a scientific basis there continue to be three conflicting interest groups on the topic of breast reductions: (a) women who suffer from symptomatic macromastia and wish to have their breast reduction to enhance their somatic, and psychological well-being paid for by the insurance company, irrespective of the resection weight, (b) the insurance companies, which are ready to pay only for genuinely medically indicated operations and who claim that the available money should be divided economically, not for the maximum benefit of a single patient but for the optimum benefit of all patients (which definitely excludes cosmetic breast reductions at the moment), and (c) the surgeons who try to provide a fair, scientific basis to differentiate between cosmetic and reconstructive indications of breast reduction for the sake of both patients and the insurance companies.

In the western part of Austria, whether a breast reduction is defined as cosmetic or reconstructive lies primarily in the hands of the plastic surgeons; the general guidelines of the insurers require that macromastia be symptomatic, and that more than 500 g breast tissue on each side in nonobese women be removed. Concerned about possible discrimination involved in such a global, generalized rule, we undertook a retrospective review of our patients' charts to examine the breast resection weight in relation to various parameters of the body proportions such as height, weight, body mass index (BMI), and body surface area (BSA). In the case of a significant discrimination of women of nonaverage weight or height, the aim of our study was either to recommend one of the few existing algorithms [17, 18] or to provide a new objective, measurable, and reproducible scaled guideline, one adapted to the individual patient's body proportions to differentiate between reconstructive and cosmetic indications for breast reduction, beyond the "500 g resection rule."

Patients and methods

All patients who had a bilateral breast reduction at our clinic between April 1997 and December 2001 were included in this study [1]. Breast reduction was defined as an operation that removed fat or breast tissue beyond the epidermis and dermis, irrespective of the amount of tissue involved. The patients were asked questions concerning their general health status, their height and weight, their complaints, and their motivations for breast reduction. Apart from determining the jugular notch to nipple distance, the internipple distance and the position of the nipple in relation to the upper arm, no further measurements on the thorax or the volume of the breast were made.

The differentiation between cosmetic and reconstructive breast reduction (i.e., less or more than 500 g) was decided in the end by one of the two most experienced surgeons and depended on the volume of the breast in relation to the body configuration. If the differentiation between cosmetic and reconstructive seemed borderline, the patients had to obtain permission also from their insurance company for coverage. This was the case in five patients (3.7%). In the cases in which both the surgeon and the insurance company were of the opinion that the breast reduction was solely cosmetically motivated, the patient had to pay for the breast reduction herself. Patients with obvious adiposity had already been re-

Table 1 Physical data of all 136 breast reduction patients. The data are listed for the group as a whole, and also according to whether the indication was judged as cosmetic or reconstructive (*BMI* body mass index, *BSA* body surface area, *CI* cosmetic indication, *RI* reconstructive indication)

	All women		CI (n=24)		RI (n=112)		P
	Mean ±SD	Range	Mean ±SD	Range	Mean ±SD	Range	
Age	33±13	16–76	37±16	17–76	33±12	16–69	0.45
Height (cm)	163±6	148–180	161±6	148–172	164±7	150–180	0.15
Weight in (kg)	66±11	42–98	61±8	42–74	68±11	49–98	0.007
BMI (kg/m^2)	25.1±3.5	19.2–37.5	23.3±2.6	18.4–27.2	25.3±3.6	19.5–37.5	0.003
BSA (m^2)	1.72±0.14	1.32–2.07	1.64±0.11	1.32–1.81	1.73±0.14	1.43–2.07	0.007

jected as operation candidates by the surgeons. "Overweight" was defined retrospectively as a body mass index (BMI) between 25 and 29.9 and "adiposity" as a BMI higher than 30 [7]. The weight of resected breast tissue on each side was obtained from measurements in the operating room and verified by a pathologist.

For the statistical analysis the "mean" resection weight was derived from the combined specimens of both breasts. The decade logarithm of the mean resection weight was plotted against the BMI and the percentiles of residuals were used to construct the 5th and 22nd percentile lines. Results were analyzed using StatView 5.0.1. (SAS Institute, Cary, N.C., USA) and SPSS (version 11.0, SPSS, Chicago, Ill., USA). Continuous variables are summarized as mean ±SD. Nominal variables are presented in terms of absolute numbers and percentages. The comparison of various variables between the cosmetic and the reconstructive group was carried out by the Mann-Whitney test. Correlations between the various height/weight parameters were indicated by Spearman's rank correlation. P values of 0.05 or less were considered significant.

Results

Of 165 consecutive patients with breast reductions, 136 could be included in the study. The resection weight ranged from 55 to 1530 g per breast (mean 450±266, median 406). Fifty-five patients (40%) had a resection weight of less than 350 g and 86 (63%) less than 500 g. In contrast, 22 (16%) patients had more than 700 g resection weight per breast. (36% classified as overweight, 7.5% as adipose). Mean BMI was 25.1. Table 1 presents the physical data of the patients. Twenty-four patients (18%) were classified a priori as undergoing the operation for cosmetic indications; these patients paid for the breast reduction themselves. In these patients the resection weight was significantly less than in the group whose operation was paid for by the insurer (mean resection weight 290 g vs. 490 g, P<0.001). Also mean body weight, BMI, and BSA were significantly lower in the "cosmetic" group: 25% of patients were overweight and no woman was adipose. Nevertheless, four of these women (17%) had a mean resection weight of more than 500 g. In the "reconstructive" group (n=112) less than the predicted 500 g of breast tissue was resected in 62 patients (46%). Forty-three of the patients (32%) in the "reconstructive" group were overweight and seven adipose. The BMI (all patients together) was correlated to the mean weight of resected breast tissue (r=0.64, P≤0.001), patient's weight (r=0.57, P≤0.001), and BSA (r=0.48, P≤0.001).

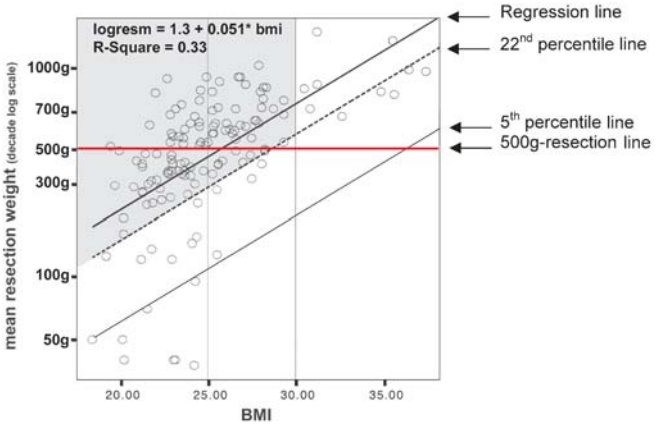

Fig. 1 The modified Schnur et al. [16] algorithm (BMI instead of BSA) applied to our patient population. The logarithmized combined specimen weights were plotted against the BMI (linear specimen weights would lead to a regression line negative for small BMI values): the 5th and the 22nd percentile line were added. The BMI of 25 and the BMI of 30 were marked vertically. The *gray area* marking the region above the 22nd percentile with a BMI greater than 30 defines the population fitting the Schnur et al. definition for a reconstructive breast reduction. The 22nd percentile line suggests the following breast reduction weights should be covered by insurers for the following representative BMI's: BMI of 15: >83 g; BMI of 20: >148 g; BMI of 25: >263 g; BMI of 30: >468 g; BMI of 35: >832 g

The decadic logarithmized mean resection weight was plotted against the BMI according and similar to the Schnur et al. [16] scheme, and the 5th and the 22nd percentiles of BMI were drawn in. This yielded a group of 101 patients (74%) fulfilling the criteria of the insurance companies in our country for a reconstructive breast reduction, i.e., BMI less than 30 (nonadipose patients) above the 22nd percentile. Using the more stringent requirements of a BMI less than 25 (nonoverweight patients) and the 22nd percentile, only 46 patients (34%) would be characterized as requiring reconstructive surgery. The combination of a BMI less than 25 and the 5th percentile as cutoff point would leave 53 patients (39%) in the "reconstructive group."

Figure 1 shows the application of the modified Schnur et al. [16] algorithm to our patient population. With this scale the range of breast reductions considered as reconstructive would reach from 83 g at a BMI of 15 to 832 g at a BMI of 35.

Discussion

Our retrospective review showed an overweight rate of more than one-third, an adiposity rate of 7.5%, and that nearly one-half of our patients had less than the mandated 500 g breast tissue resected. These data demonstrate that basing the differentiation between "reconstructive" and "cosmetic" breast reduction (and the resulting issue of insurance coverage) on a standardized resection weight or the body weight of the patient alone, leads to many false-positive and false-negative decisions. Other authors report similar difficulty; in 31 of 100 patients it was not possible to determine in advance whether the insurance company's requirements would be met [18].

We are convinced that every responsible plastic surgeon, given the choice of resecting the "necessary amount" of breast tissue to fulfill the criteria for insurance coverage or shaping a beautiful breast that is not too small for the body build, would choose the latter option. While the resection weight is still probably the most objective criterion to differentiate between cosmetic and reconstructive indications for breast reductions, our results show that the 500-g rule is very disadvantageous to small, slim women and advantageous to adipose women. This bias was obviously also the reason why Schnur et al. [16] introduced their BSA-based algorithm. If similar criteria were applied to our series (Fig. 1), there would be a range of reconstructive resections weights from 80 g to 830 g within the 15–35 BMI range. We would not regard a resection weight of 80 g breast tissue as curative in any women.

A further controversial point in the study by Schnur et al. is the fact that the 5th and 22nd percentiles as cutoff points were established empirically on the basis of the opinion of 132 plastic surgeons as to how many women have their breasts reduced for purely cosmetic or reconstructive purposes. Doubtless this conclusion can be a source of bias; the authors themselves state that these are "soft data." Seitckik [18] states that it is impossible to construct a useful formula for verifying subjective complaints of discomfort or the prospect of their relief by surgery based on body dimension or specimen weight alone. He suggests a graded minimum specimen weight standard: 200 g per breast for body weight less than 60 kg; 350 g for body weight of 61–79 kg; and 500 g for body weight greater than 80 kg. As this recommendation relies on the body weight alone and does not consider body build, such a rule would disadvantage tall women. For this reason we would not wish to use this recommendation.

Our guideline, also based on an arbitrary, stepwise minimum resection weight proposal, relies instead on BMI, which is the variable most closely correlated to body build in our patients. The BMI must be calculated in any case for the health insurance companies prior to surgery to determine whether the patient is of normal weight, overweight, or adipose. For our algorithm we decided that the required minimum 500 g resection weight was appropriate to be correlated to the mean BMI of 25.

Table 2 BMI-related scale of individual specimen weight limits for a reconstructive indication (for health insurance purposes) in breast reduction operations in macromastia (note the much broader range of correlated breast resection weights in the Schnur et al. algorithm in Fig. 1). This scheme derives from an arbitrary multistep scale, beginning with a BMI of 15 and a resection weight of 300 g, and proceeding with 0.5 steps in the BMI scale and 10 g steps in the resection weight scale

BMI	g
15–20 (underweight)	>300
20–25	>400
25–30 (overweight)	>500
30–35 (adiposity)[a]	>600
>35	>700

[a] From a BMI of >30 onwards, breast reduction is deferred in favor of general weight reduction

Beneath the BMI of 25 the required resection weight would be lower, and above a BMI of 25 it should be higher (Table 2). Such a simple, graded scale handles all women, including those who are small or tall or slim, fairly, and overweight and adipose women are motivated to reduce weight before breast reduction.

Overweight or adiposity seems to be significantly correlated with breast hypertrophy [15]. A prospective study [9] in 39 women on improving symptoms of macromastia by breast reduction found a mean BMI of 28.5, compared to a value of 22.3 in a control group of 40 female volunteers. Another survey [6] came to the same conclusion: 60% of 406 women were 5–10 kg over their ideal body weight, and the size of breast reduction was significantly correlated with excess body weight ($P<0.001$). Similarly, Kerrigan et al. [10] compared three groups of women in a very interesting study on 486 patients from a broad geographic region in the United States: women with breast hypertrophy who seek surgical treatment, women with breast hypertrophy who do not seek surgical treatment, and women without breast hypertrophy. The authors found a significantly different ($P\leq0.001$) mean BMI between the first two groups (>30, i.e., adipose) and the latter group (BMI of 24.9), and this difference was significantly correlated with lower ($P=0.004$) comorbid conditions in the normal group. In addition, patients had to complete self-reported questionnaires, including the European Quality of Life, McGill Pain Questionnaire, Multidimensional Body-Self Relations Questionnaire, the Short Form-36 Questionnaire, and "breast-related symptoms." Patients with breast hypertrophy who did not seek operation had significantly better scores than the surgical candidates yet significantly worse scores than the normal control subjects.

Not only macromastia but also associated adiposity seems to be a considerable health burden; sometimes it is difficult to distinguish between the symptoms of the two. Damush et al. [5], for example, found a significant impact of BMI on changes in health-related quality of life in a prospective longitudinal study on 7895 adults. Coakley et al. [3] concluded from a cross-sectional study

on 5,610 women that adiposity is associated with lower activity levels, with lower feelings of well-being, and a greater burden of pain (Short Form-36 questionnaire)—symptoms that also resemble breast-related symptoms. Despite this proven knowledge, in countries with a high percentage of adipose women there is a tendency to define breast reductions as a medical necessity, irrespective of the resection weight or the BMI [11]. In our country we think that women with a BMI higher than 30 would benefit more from a weight reduction program paid by the insurance companies than from a breast reduction alone.

In conclusion, we propose using the BMI as the basis for a graduated, fair weight resection standard for reconstructive breast reductions. If BMI is higher than 30, breast reduction should be postponed in favor of general weight reduction, whenever possible, for the sake of a higher impact on general well-being. Our algorithm, although arbitrary, is based solely on objective data and thus avoids individual subjective biases and the difficulty of trying to quantify breast- (or adiposity-) related pain syndromes. The BMI-based algorithm respects the fact that women have many different types body build, and treats all types fairly.

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