Breast surgery: A problem of beauty or health?

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Chapter II

Hypertrophy of the breast: a problem of beauty or health?

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Introduction

The most common symptoms of women suffering from breast hypertrophy are mal-posture, painful shoulder grooves, submammary intertrigo and back pain[1-8]. Furthermore different authors reported upper extremity neurologic symptoms caused by excessive breast size, like ulnar nerve paresthesias[9], hand numbness[10] and carpal tunnel syndrome[11]. These findings may result from brachial plexus compression between the coracoid process of the scapula and the rib cage as forward depression of the shoulders tilts the coracoid downward[11]. Starley et al.[12] reported reduction of lung function, suggesting that a heavy breast mass leads to decreased chest wall compliance.

In addition to these physical symptoms, macromastia has cosmetic and psychological components. The breast plays an important role in female self-confidence. Therefore breast hypertrophy is associated with heightened body image dissatisfaction. Patients may have decreased self-confidence due to difficulties while exercising, problems finding properly fitting clothes or impaired personal relationships and social life[1-8].

A detailed overview of the literature was given recently by Young and Watson[13]. They conclude, that the majority of women with macromastia pursue breast reduction surgery to relieve the physical symptoms, which also interfere with the ability to keep up daily life activities. But Young and Watson also point out that especially young women may be more strongly motivated to have surgery because of psychosocial concerns, although they suffer from physical problems. Young women tend to adopt strategies to camouflage their breasts and the emotional and social repercussions of abnormally large breasts in adolescence may resonate throughout adulthood. As Young and Watson discuss, complaints about physical symptoms are more often voiced by older women, perhaps because of the accumulated years of carrying heavy weight on the chest, which can place unnatural loading on the upper body[14].

Because of this complex health burden for women with breast hypertrophy, reduction mammoplasty is considered reconstructive in nature[13] and is the most common operation on the female breast in plastic surgery today. With a rate of up to 9.5 in 100,000 women[15] it ranks among the top five reconstructive procedures[16]. In 2006, 104.000 breast reduction procedures were performed in the United States by board-certified plastic surgeons[17].

On the other hand, cosmetic surgery procedures have increased at a dramatic rate[16], since the enigma of beauty is epitomised in our culture. But, cosmetic surgery is excluded from service contracts. Selective access policies are designed to restrict expenditure on certain procedures, and non-urgent plastic surgical cases, such as breast reduction, have become targets. Beside the fact that the official definition of reconstructive surgery by the American Society of Plastic Surgeons considers reduction mammoplasty to be reconstructive in nature[13], the general public and many medical professionals consider reduction mammoplasty to be more a cosmetic than a functional operation. As a result, insurers do not accept that symptomatic macromastia is a significant health burden. Unfortunately, denials of insurance coverage and policy exclusions for breast reduction are becoming increasingly common in Europe as well as in the United States[15,18,19] and the justification for outright rejection of funding is often unknown[20]. Although previously published longitudinal studies showed that reduction mammoplasty will reliably provide the desired improvement of all symptoms and improvement in the quality of a women's life[1-8,13], a continuous discussion is ongoing about whether reduction mammoplasty is a cosmetic or reconstructive procedure.

To elucidate this question the aim of our study was to demonstrate using reliable measurements the influence of breast weight on the physical and psychological morbidity of women.

Materials and Methods

Study design and population

We performed a cohort study of 50 women with various breast sizes, a mean age of 28 years (range: 20 – 40 years, SD: 4.94) and a body mass index (BMI) less than 25 (mean: 21.9, SD: 2.16). The women were recruited from nurses of our department, medical students and women consulting our outpatient clinic for breast reduction surgery as well as other reasons. A balanced representation of individuals with respect to Cup-size (A-C vs. ≥ D) and age (20-29 years vs. 30 – 40 years) was achieved.

In order to reduce the confounding effect of overweight, the body mass index had to be less than 25 according to the 1998 National Heart, Lung and Blood Institute criteria[21] (normal < 25 kg/m^2, overweight 25 – 29,9 kg/m^2, obese > 30 kg/m^2). Also women with traumatic or other known spine diseases were excluded from the study.

All women were Caucasian, well educated (at least 12 years of education) and employed. All women were asked for participation without payment. The women with hypertrophic breasts were specifically told that the responses given in this study were confidential and would not impact on their treatment, thus eliminating any possible confounding motive in their responses.

Local ethics committee approval was obtained and all women had to give informed consent to participate under the guidelines of the local ethics committee.

The following data were obtained: breast volume, magnet resonance imaging of the spine, physical examination and interview as described below.

Volumetric measurement of the breast

A specific device based on the principle of water displacement was constructed by technicians of the department of Biomedical Engineering and Physics of the Medical University of Vienna. The amount of displaced water was weighted and multiplied by a breast tissue specific factor (mass density of breast tissue = 940 kg/m^3)[22]. The validity and reliability of this method was demonstrated in previous studies. For statistical analysis the weight of both breasts was added.

Magnetic Resonance Imaging (MRI) of the spine

Degenerative changes in the cervical and thoracic discs were studied by MRI and evaluated by loss of signal characteristics, posterior and anterior disc protrusion, narrowing of the disc space and foraminal stenosis. We examined the alignment for deviations in the frontal and sagittal plain.

For MRI a 1.5 T scanner (Magnetom Vision, Siemens, Erlangen, Germany) with a phased array spine coil was used. We obtained localiser sequences in the coronal plane for planning the sagittal and axial sequences. The following sequences were applied: sagittal T1-FSE (TR/TE: 700/12ms; Turbofactor: 3), sagittal T2-FSE (TR/TE: 4700/112ms; Turbofactor: 15). For both sequences the matrix size was 390x512 mm, Field of view: 360x480 and the slice thickness 2mm. Additionally, an axial FISP-3D sequence (TR/TE/Flip-ankle: 40/15/5°) was performed. For this sequence the matrix size was 128x256 mm, the field of view: 200 and the slice thickness 2 mm.

For statistical analyses pathological findings were graded as 1 and 0, for degenerative and no changes, respectively. The assessments were made blindly by two independent, experienced radiologists.

Functional evaluation of the spine

To evaluate the functional status of the spine a grading system was used, based on the assessment of posture, mobility of the cervical spine, muscular dis-balance and musculoskeletal pain. According to the specific symptoms described for women with high breast weight[14,15] it was looked for the presence of scoliosis, the presence of deviated head position, the presence of shoulder protraction in habitual or corrected sitting position, the shortening of the pectoralis muscles, the strength of the abdominal muscles and back extensor muscles. The mobility of the cervical spine

Table 1. “spine score”: grading system for the functional status of the spine, maximal total score =12

Item		Score
Scoliosis	yes | no	1/0
Deviated position of the head	yes | no	1/0
Shoulder protraction habitual	yes | no	1/0
Shoulder protraction corrected	yes | no	1/0
Mobility of the cervical spin restricted	yes | no	1/0
Shortening of the tendons	yes | no	1/0
Muscle strength of the abdominal wall	Janda 1-5	4 - 0
Muscle strength of the back extensors	Kendall 50-100%	2 - 0

was measured by a hand goniometer according to the neutral-zero method and the muscle strength of the abdominal wall and the back extensors was obtained using Janda’s[23] and Kendall’s[24] standardised grading scale (table 1).

Scoliosis, spine deviation in the sagittal plane and head posture were assessed in standing position. A spine deviation was scored as 1, no deviation as 0. A correct head posture was assumed if the meatus acusticus externus was in ligne with the hip joint axis. Any deviation to the front was regarded as deviation of the correct head position and was scored as 1, no deviation as 0. Shoulder protraction was assessed in sitting position. Shoulder position was described as being protracted (score 1) or normal (score 0). For measurements of the length of the pectoralis muscle the woman was lying supine, elevating the arms over the head. Shortening was assumed when the arms did not reach the table and scored as 1. Normal length was considered 0. Cervical spine mobility was assessed for the sitting patient. Restricted cervical spine mobility was scored as 1, unrestricted as 0. For muscle strength assessment of the abdominal wall the woman was lying supine, strength was assessed according to Janda’s grading system from 1 to 5 (grade 5 stands for normal strength and grade 1 for highly reduced strength). For the spine score in our study grade 5 was scored as 0 and grade 1 as 4. For muscle strength assessment of the back extensors according to Kendall’s strength grades were scored from 2 (highly reduced strength) to 0 (normal strength). Maximum score was 12. The higher the score, the higher was the functional impairment of the spine. All measurements were performed by a single physical therapist.

Pain intensity

A visual analogue scale (VAS) was used to quantify pain intensity. This scale consists of a 10-cm line with each centimeter numbered 0 to 10. At the left (0), the words "no pain" are typed, and at the right (10), the words "worst possible pain" are typed. The patient is asked to mark on the scale an estimation of their current level of pain[25].

Assessment of depressive symptoms

All women completed the Beck Depression Inventory[26] (BDI). The Beck Depression Inventory defines 3 grades of depressive symptoms by a scoring system:

1. no depression (score $\leq$ 11)
2. mild depression (score 12–17)
3. severe depression (score $\geq$ 18)

Statistical analyses

The effects of age, breast weight and BMI on pathologic findings in the MRI were quantified and tested for significance by means of multiple logistic regression analysis. Associations of BDI and spine-score values with other patient characteristics were quantified and tested for significance by Spearman correlation coefficients. Partial Spearman correlations served to eliminate the effect of BMI and age on correlations of BDI and spine-score values with breast weight. All statistical analyses utilised programs of SAS (SAS Institute, Cary, NC, USA).

Results

Breast weight measurement

A median total breast weight of both breasts of 1666 g was found (range: 418 – 3628 g). The correlation of breast weight to the bra-cup size is shown in figure 1. Concerning the definition for breast hypertrophy, as reported in the literature by cup size D or larger, the corresponding breast weight for the smallest cup size D was 1741 g.

The mean BMI of all women was 21,8 kg/ m^2 (range: 17-25 kg/m^2).

Table 2 shows that the breast weight is correlated with the MRI-score, the spine score, pain, BDI, age and BMI. Adjustment of these correlations by age and BMI did neither substantially modify correlations or p-values.

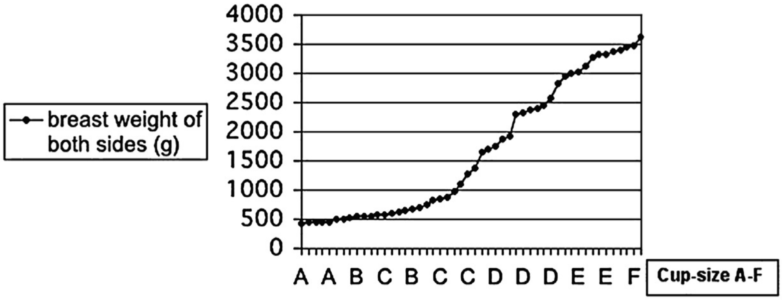

Figure 1. Breast weight of all individuals included in the population according to bra size

Table 2. Upper triangle: Spearman Correlations of all variables considered, lower triangle: Partial Spearman Correlations of the variables considered, adjusted for age and BMI

	Breast weight	MRI score	Spine score	Pain	BDI	Age	BMI
Breast weight	1.0	0.41 p=0.0037	0.71 p<0.0001	0.69 p<0.0001	0.58 p<0.0001	-0.22 p=0.118	0.57 p<0.0001
MRI score	0.42 p=0.0041	1.0	0.51 p=0.0002	0.46 p=0.0012	0.3 p=0.038	0.25 p=0.085	0.34 p=0.0189
Spine score	0.63 p<0.0001	0.48 p=0.001	1.0	0.75 p<0.0001	0.44 p=0.0013	-0.04 p=0.763	0.51 p=0.0001
Pain	0.6 p<0.0001	0.4 p=0.0078	0.66 p<0.0001	1.0	0.61 p<0.0001	0.04 p=0.785	0.58 p<0.0001
BDI	0.5 p=0.0006	0.23 p=0.13	0.31 p=0.04	0.55 p=0.0001	1.0	-0.18 p=0.219	0.37 p=0.0093
Age						1.0	0.0095 p=0.9476

MRI of the cervical and thoracic spine

In 16 out of 50 women a pathologic MRI result was found. In 1 woman a disc-protrusion beyond the margin of the vertebral bodies was seen. 8 women had a disc-protrusion within the anterior margin of the vertebral bodies. In 10 women other degenerative abnormalities were found.

For the MRI-score we observed a statistically significant correlation with breast weight, spine-score, pain BDI and BMI. Between MRI-score and age no significant correlation was detected. After adjustment of these correlations by age and BMI the correlation of MRI-score and BDI is not significant anymore, which might show the influence of BMI on these parameter (Table 3).

Table 3. Effect of the three most important factors for degenerative spine disorders classified by MRI according to multiple logistic regression.

Factors	Estimated relative risk (95% conf. interval)	P-value
Age (per 10 years)	5.7 (1.2 – 27)	0.03
BMI	1.1 (0.7-1.7)	0.7
Breast weight (per kg)	2.7 (1.2-6.1)	0.02

Multiple logistic regression analysis (using breast weight, age and BMI as predictors) gave evidence that the independent effect of breast weight on pathologic findings in the MRI is confirmed (p=0.02), as is the effect of age (p=0.03). In addition to age and breast weight, the body-mass-index was of no predictive relevance (Table 2).

For each additional 10 years the relative risk to develop a degenerative spine disorder increases 5.7 fold and for each additional kg of breast weight 2.7 fold. The resulting probabilities for degenerative spine disorders are summarised in table 2 and the effect of breast weight by age are plotted in figure 3.

Spine Score

In the whole cohort the mean score of functional impairment of the spine was 2.62 (range: 0 – 9). The statistical analysis of the data by the spearman correlation coefficient "r" showed a significant correlation between the spine score and the BMI as well as the breast weight, the MRI-score, the BDI and the pain defined by the visual

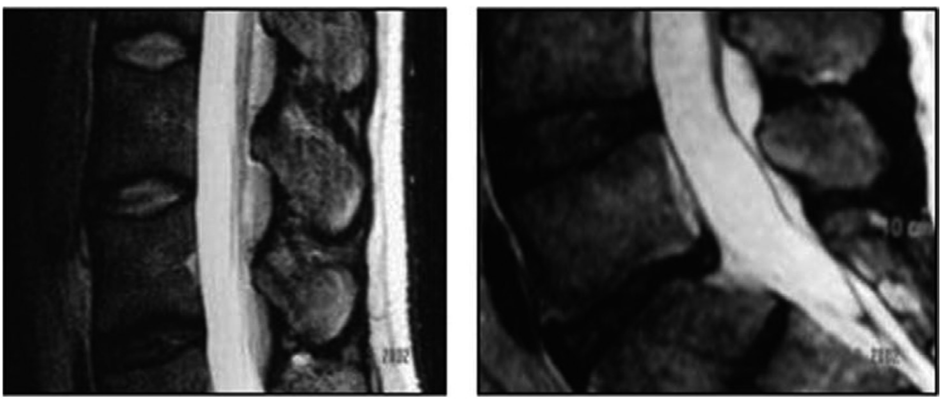

Figure 2a & 2b. Degenerative morphological changes (2a) and a prolapse of an intervertebral disc (2b) shown by MRI in women with breast hypertrophy.

analogue scale VAS, which does not change after adjustment for age and BMI. In our selected group no significant correlation was found between the spine score and age (Table 3).

Back pain

The mean cumulative visual analogue scale score for all participants was 3.02 (range, 0-10). The unadjusted spearman correlation coefficient "r" showed significant correlation between pain and breast weight, MRI-score, Spine-score, BDI and BMI. These correlations are not changed by adjustment for age and BMI (Table 3).

Beck Depression Scale

11 out of 50 women showed symptoms of a mild or severe depression analogue to the Beck Depression Inventory. 6 out of 11 had signs of a mild (score 12-17), 5 out of 11 of a severe (score >/= 18) depression (mean: 7.37, SD: 8.39).

The statistical analysis by the spearman correlation coefficient showed a significant correlation of the score of depressive symptoms and all other measured parameters beside age. Adjusted for age and BMI there was no further significant correlation found between the value of depressive symptoms and the MRI score (Table 3).

Discussion

This cohort study demonstrates the impact of breast weight on the morbidity of 20 – 40 year old women. In particular, the results of pathologic findings in the MRI show conclusively the increased risk of developing a spine disorder in women with heavy breasts. The risk has been shown to be related to the patients' age[27], but additionally the risk is 2,7 times higher per kilogram of increased breast weight. As an example, the corresponding probability of developing a spine disorder for a 25-year-old woman with 800 g breast weight (cup size B) is 8%; for 25-year-old woman with 2800 g breast weight (cup size D) it is 44%. Compared to this the risk for a 35-year-old woman with 800 g breast weight is 34% and for a 35-year-old woman with 2800 g breast weight it is 82 % (fig. 3).

By using standardised muscle and posture testing we have shown the morphologic changes caused by increased breast weight and a validated pain scoring demonstrated the high level of pain in woman with heavy breasts. Our results, similar to those published by Chao et al.[7] illustrated the functional disability in patients with macromastia.

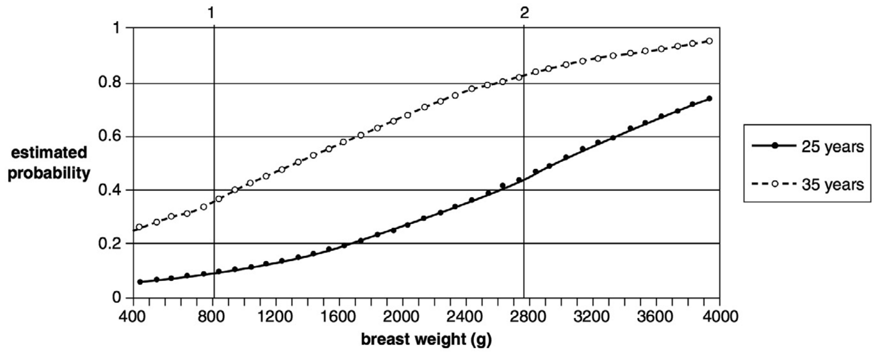

Figure 3. Estimated probabilities for degenerative spine disorders (as diagnosed by MRI), effect of breast weight and age. Line 1: 800gr/25 years old: risk 8%; 800gr/35 years old: risk 34%. Line 2: 2800gr/25 years old: risk 44%; 2800gr/35 years old: risk 82%.

Additionally, the psychological impairment caused by increased breast weight was demonstrated by the high incidence of depressive symptoms in heavy breasted women by means of the Beck Depression Inventory.

Our data show that body weight as measured by Body Mass Index also has an impact on development of spine disorders, mal-posture and depressive symptoms. A correlation between obesity and depressive symptoms had been previously described[28]. Therefore we suggest that weight reduction might support risk reduction. However, it is notable that Glatt et al.[1] found that symptom relief and improved body image occurred after breast reduction independently of preoperative body weight. In addition, there is a high prevalence of obesity in patients seeking breast reduction and these women also benefit from breast reduction surgery, as reported by Collins et al.[29].

Weight seemed to have an influence on all parameters, but by excluding obese women from this study and adjusting the analysis of the effect of breast weight on BMI, the confounding effect of weight was avoided. As a result our cohort might be not representative for the typical population of women seeking breast reduction, but by focusing on the effect of breast weight, it was necessary to exclude obese women from the study. For the same reason, women older than 40 years were excluded from the study, since age has a well known impact on spine pathology. As our data show an effect of age on pathologic findings in the MRI even in women younger than 40, we believe older women might benefit from reduction mammoplasty.

A further study of a larger number of women, including obese women and women older than 40, would allow this issue to be proved statistically.

Limitations of our study include the small sample size, as well as the predominantly affluent Caucasian population that comprises the study cohort. Further study of a more racially and economically diverse population may be warranted.

Thus far no definite breast weight has been defined at which reduction mammoplasty is necessarily indicated to prevent a subsequent morphological or psychological disease. Apart from those insurance companies that do not cover the procedure at all, most companies reimburse the cost of a resection involving more than 500 g tissue per breast. Kerrigan et al.[30] stated that a woman with cup-size D or larger would benefit from breast reduction surgery. Our data show that the minimum breast weight of a breast with cup-size D is approximately 900 g per side compared to approximately 380 g in a breast with cup-size B. Therefore, we suggest that 500 g is a reasonable weight of tissue to remove in women with Cup size D or larger. Nevertheless, we emphasise that declaring a minimum of 500 g resection-weight per breast to differentiate between cosmetic and reconstructive indications might be disadvantageous to very small and slim women. For this reason Schnur et al.[31] as well as Kompatscher et al.[32] calculated scales of individual specimen weight limits for a reconstructive indication in breast reduction operations adapted to the individual patients body proportions. As stated by Collins et al.[29] it makes more sense to use the physical symptoms of the patients as the criteria for insurance coverage instead of the amount of removed tissue.

The question arises if nonsurgical interventions could be an alternative to reduction mammaplasty. To answer this question Collins et al.[29] performed a prospective study comparing a surgical intervention group with a group including women with hypertrophic breasts and a control group of women with cup-size < D. In this study, conservative measures such as weight loss, physical therapy, special brassieres and medications did not provide sufficient and permanent relief of symptoms in patients with macromastia.

Conclusions

These data give the objective evidence that breast weight has an influence on the physical and psychological morbidity of women, and therefore challenges the basis for resource allocation decisions with regard to breast reduction surgery.

The results should guide insurance companies to establish a uniform and appropriate selection procedure that ensures equitable access.

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