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Effects of Breast Reduction on Pulmonary Function

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Macromastia causes several health problems, and reduction surgery alleviates them successfully. The purpose of this study was to investigate whether reduction mammaplasty improves possible impairments on pulmonary functions related to macromastia. Thirty-one patients participated in the study. Pulmonary function tests were performed before and 3 months after surgery with a spirometry. Preoperative and postoperative pulmonary function values were compared using a paired *t* test. Two patients were found to have mild restriction in preoperative spirometric analysis, and they went to normal range in postoperative analysis. All other patients were assessed as having normal values in both preoperative and postoperative analyses. Preoperative and postoperative forced vital capacity values were 2.72 ± 0.06 and 2.79 ± 0.05 L, respectively. The difference was statistically significant (paired *t* test, $P = 0.014$). The other parameter in which breast reduction had statistically significant improvement was forced vital capacity performed/predicted ratio (paired *t* test, $P = 0.041$). Additionally, the weight of resected breast tissue correlated significantly with the change of forced vital capacity (Pearson correlation coefficient = 0.379, $P = 0.036$). Breast reduction surgery improves the pulmonary function parameters that are mainly influenced by restrictive states. This result led us to consider that macromastia causes a relative restriction in chest wall compliance, and reduction of breast weight may enhance chest wall compliance and improve pulmonary function.

Key words: Breast reduction – Chest compliance – Pulmonary function – Spirometry

Macromastia is commonly associated with physical symptoms, including neck, back, shoulder, and breast pain; painful brassiere strap grooving; intertrigo; poor posture; and difficulty exercising. It is also often associated with psychologic symptoms related to unwanted attention,

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difficulty finding clothing that fits, and low self-esteem.[1] There are a lot of studies reporting on the salutary effects of reduction mammaplasty on women with macromastia.[2–5] However, outcome measures in assessing the result of the procedure are mostly subjective, and there is a need to produce objective measures for evaluating the efficacy of reduction mammaplasty.

During breast reduction operations, several times our anesthesiologists have noted a decrease in peak inspiratory pressure just after mammary tissue resection, and this observation provoked us to perform an analysis about the effect of breast reduction on lung functions.

The aim of this study was to answer the question of whether lung function improves after breast reduction. This prospective study was designed to evaluate the effect of breast reduction on lung function in women with macromastia.

Patients and Methods

Local ethics committee approval was granted for the study. All patients requesting reduction mammaplasty between January 2011 and June 2012 for symptoms of macromastia were invited to participate in this study. The participating patients signed an informed consent form. Exclusion criteria were smoking, preexisting lung disease, chronic joint problems, and a history of previous thoracic or upper abdominal surgery. A recent history of upper respiratory tract infection was also accepted as an exclusion criterion because it might affect the results of pulmonary function test (PFT).

The evaluation of pulmonary function was performed by conventional spirometry using Spirolab III (Medical International Research Inc, Waukesha, Wisconsin) according to the standards of the American Thoracic Society.[6] Full calibration and verification of the equipment were carried out prior to each test. All of the tests were performed in the morning between 9 AM and 11 AM by the same trained respiratory unit technician. The procedure was explained to patients before the start of the test.

The evaluated spirometric parameters were forced vital capacity (FVC), the volume of air expired forcibly as fast as possible after the patient has taken in the deepest possible breath; forced expiratory volume in 1 second (FEV1), the volume of air that can be forcibly exhaled from the lungs in the first second of a forced expiratory maneuver; FEV1/FVC ratio, the percentage of the total FVC expelled from the lungs during the first second; maximal voluntary ventilation (MVV), the volume of air expired by carrying out a series of forced inspirations and expirations with maximum possible amplitude; and peak expiratory flow (PEF), the maximal expiratory flow rates achieved by the patient during the FVC maneuver.

Results were expressed as absolute values and as percentages of the reference predicted values computed by taking into account various parameters, such as age, sex, body mass index, height, weight, and race of the patient, according to the protocol of the European Respiratory Society. A value is usually considered abnormal if it is less than 80% of the predicted value.

All patients then underwent bilateral reduction mammaplasty. Three months after surgery, PFT was repeated. Additional data collected were age, body mass index, and weight of the resected mammary specimens.

Statistical Analysis

Data are presented as mean ± SEM. A paired *t* test was used to compare the change in respiratory function parameters. Pearson correlations were used to assess any influence of specimen weight or body mass index on any changes in PFT. Statistical analyses were performed using the SPSS statistical software package, version 13.0 (SPSS Inc, Chicago, Illinois) at a significance level of $P < 0.05$. Data are presented as mean ± SEM.

Results

A total of 38 patients went to reduction mammaplasty during the study period, and 5 of them were not eligible for enrollment due to smoking (2 patients), a history of allergic asthma (1 patient), and previous upper abdominal surgery (2 patients). Also, one of the eligible patients did not want to participate in the study. Thirty-two participants were recruited, and all but one woman completed the study. The mean age of these 31 women was 37.8 ± 2.2 years, and the mean weight of the tissue removed from both breasts was 1630 ± 58 g. Body mass index ranged from 21.3 to 35.8, with a mean of 30.8 ± 0.6.

In preoperative spirometric analysis, 2 patients were found to have mild restriction and the others had normal values. All patients were in the normal range according to the same test in postoperative assessment.

Table 1 Preoperative and postoperative FVC values and the difference between them[a]

Patient No.	Preoperative FVC	Postoperative FVC	Difference
1	2.72	2.60	−0.12
2	2.72	2.82	0.10
3	2.82	2.74	−0.08
4	2.82	3.00	0.18
5	2.56	2.78	0.22
6	2.72	2.62	−0.10
7	2.5	2.64	0.14
8	2.76	2.72	−0.04
9	2.82	2.68	−0.14
10	2.82	2.98	0.16
11	2.54	2.66	0.12
12	3.12	3.24	0.12
13	3.98	3.82	−0.16
14	3.32	3.40	0.08
15	2.72	2.56	−0.16
16	2.52	2.70	0.18
17	2.12	2.42	0.30
18	2.52	2.48	−0.04
19	2.50	2.68	0.18
20	2.72	2.74	0.02
21	2.12	2.32	0.20
22	3.02	2.96	−0.06
23	2.82	3.02	0.20
24	2.56	2.72	0.16
25	2.66	2.54	−0.12
26	2.76	2.64	−0.12
27	2.62	2.80	0.18
28	2.92	3.08	0.16
29	2.50	2.68	0.18
30	2.52	2.74	0.22
31	2.54	2.60	0.06
Average	2.72	2.79	0.07

[a]Values are given in liters.

There were no statistical differences between preoperative and postoperative values for FEV1, FEV1/FVC ratio, PEF, and MVV. Preoperative and postoperative FVC values are presented in Table 1, and their average values were 2.72 ± 0.06 and 2.79 ± 0.05 L, respectively. The difference was statistically significant (paired t test, $P = 0.014$). The other parameter in which breast reduction had statistically significant improvement was FVC performed/predicted ratio (paired t test, $P = 0.041$). Preoperative and postoperative spirometric parameters are seen in Table 2. Additionally, the weight of resected breast tissue correlated significantly with the change of FVC (Pearson correlation coefficient = 0.379, $P = 0.036$). The correlation line is seen in Fig. 1. There was not any significant correlation between body mass index and the changes in PFT.

Table 2 Spirometric values of the patients[a]

Parameters	Preoperative	Postoperative	P
FVC, L	2.72 (0.06)	2.79 (0.05)	0.014*
FVC performed/predicted, %	81.9 (0.91)	83.8 (0.87)	0.041*
FEV1, L	2.46 (0.11)	2.48 (0.13)	0.612
FEV1 performed/predicted, %	85.7 (1.17)	86.4 (1.23)	0.393
FEV1/FVC	90.4 (1.27)	88.8 (1.32)	0.126
FEV1/FVC performed/predicted, %	107.4 (1.22)	105.8 (1.18)	0.214
PEF, L/s	6.11 (0.21)	6.19 (0.19)	0.103
PEF performed/predicted, %	91.4 (1.24)	92.3 (1.21)	0.141
MVV, L/min	101.2 (0.67)	102.5 (0.72)	0.179
MVV performed/predicted, %	95.2 (0.71)	96.4 (0.75)	0.154

[a]Results are expressed as mean, with SEM in parentheses.
*Statistically significant result, $P < 0.05$.

Discussion

Many quality-of-life studies reported significant improvements in all parameters assessed in women undergoing reduction mammaplasty.[3–5] These studies were inherently built on subjective assessment. However, there have been a limited number of reports that investigate objective physical parameters related to this surgical procedure, and a few of them presented the changes in pulmonary function in patients undergoing breast reduction.

In 1974, Goldwyn[7] studied 10 patients before and after mammary reduction operation and reported

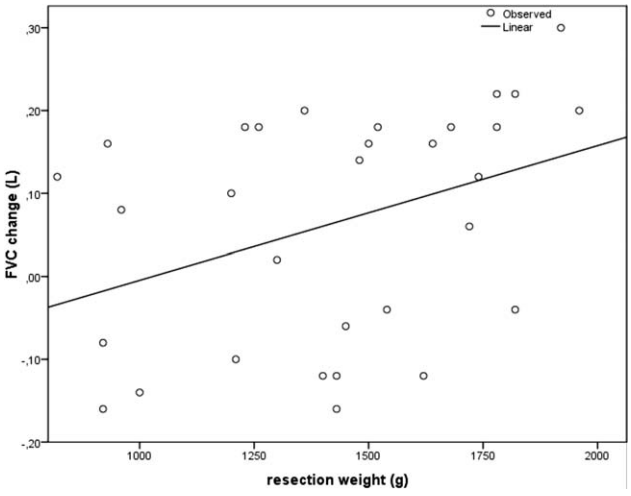

Fig. 1 Correlation between excised mammary tissue weight (g) and changes in FVC (L). Pearson correlation coefficient = 0.379, $P = 0.036$.

that there was not any change in pulmonary function tests. Starley *et al*,[8] in a study with 19 patients, found that there were statistically significant improvements in PEF and PIF rates. In 2003, Sood *et al*[9] reported statistically significant improvements in the parameters of inspiratory capacity, PEF, and MVV. Additionally, the amount of change in MVV parameter was found to be positively correlated with body mass index. In 2006, Iwuagwu *et al*[10] published a randomized, controlled study with 73 patients, finding a significant improvement in the percentage of FVC performed/predicted in the intervention group. Also, FVC, FEV1/FVC, and PEF parameters had a positive correlation with the weight of resected breast.[10] In 2011, Cunha *et al*[11] revealed a statistically significant increase in total lung capacity and residual volume after breast reduction in a study with 12 patients.

This study also revealed that reduction mammaplasty made significant improvements in FVC and the ratio of FVC performed/predicted parameters. In addition, there was a correlation between the weight of the resected specimen and the change in FVC values. No significant effects of reduction mammaplasty on FEV1 and the ratio of FEV1/FVC parameters were determined. FEV1 and particularly the FEV1/FVC ratio are significant parameters in assessing obstructive-type lung diseases, and their reduced values indicate an obstructive condition,[12,13] whereas FVC decrease may denote a restrictive state.[13] Additionally, 2 of 31 women had a mild restrictive condition before surgery, and they went to normal range after breast reduction. From these findings it may be suggested that macromastia does not have an obstructive effect, but rather a restrictive one. Cunha *et al*[11] also claimed that big and bulky breasts could exert a restraining effect on the chest and decrease chest wall compliance. As a support to this idea, it was revealed that increased mass over the chest in the morbid obesity can decrease chest wall compliance.[14,15]

In order to obtain maximal reliability, the same operator performed all tests. The diurnal variation in PFT was minimized by applying tests at similar times of day, between 9 AM and 11 AM. Also, it was decided to wait 3 months after surgery before repeating PFT in order to avoid the probable restraining effect of pain related to surgery.

It might be proposed that investigating the effect of breast reduction on pulmonary functions is meaningless because both preoperative and postoperative PFT values were in the normal range in similar studies.[8–10] Also, it seems there is not a problem at all. Actually, pulmonary functions have a large reserve, which evinces itself as a wide normal range. It is well known that any system with a large reserve can tolerate impairments to a wide extent. PFT might be still in the normal range even if there is some impairment on the respiratory system. Thus, a PFT value in a normal range and an absence of respiratory symptoms do not mean the absence of impairment on the respiratory system.

Besides the recovery from a mild restrictive state in our 2 patients, the improvement in the parameters related to restrictive condition after breast reduction supports the idea that macromastia causes a decline of PFT values in the normal range. Additional impairments can alter the condition and result in PFT values dropping out of the normal range. So, in patients with macromastia, any contributing intervention to pulmonary function, such as breast reduction, would be beneficial in future troubles. Removal of the excessive weight from the anterior chest wall would facilitate chest movements, and thus would improve chest compliance.[16]

The limitation of the study was the use of spirometry alone in the evaluation of pulmonary function. Although spirometry can provide useful diagnostic and screening information and show restrictive or obstructive disease patterns, in some cases it may not be sensitive enough to show abnormalities before extensive and irreversible damage has been done.[15] Other, more sensitive methods, such as arterial gas measurement, might also have been used to assess pulmonary functions, but their usage would be inconvenient in patients who do not have any respiratory symptoms.

There could be a bias in the results because the patients might improve or modify an aspect of their behavior being experimentally measured simply in response to the fact that they know they are being studied. However, this effect is a question for every parameter studied, and only two of them had a significant change. Also, each PFT test consisted of at least 3 trials, and the best value was accepted as the result. This technique might reduce this kind of bias.

In conclusion, macromastia with an increased weight on the chest can cause a relative restriction in chest wall compliance and impair pulmonary function, and therefore reduction of breast weight may enhance chest wall compliance and improve pulmonary function.

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