EFFECT OF REDUCTION MAMMOPLASTY ON THE PULMONARY FUNCTION TEST

Ahmed Mohamed Aly, Mostafa Hassan Abdel Salam., Doaa Mostafa Gad .

Plastic Surgery, physiology, and Chest disease Departments, Faculty of Medicine, Zagazig University

ABSTRACT

The effect of reduction mammoplasty on the pulmonary function was a controversial subject since long time. Some studies stated its beneficial effect, and others denied it. In this study we will try to clarify the effect of reduction of the size of big breast on the pulmonary function tests. **Patients and method:** This study was performed on 42 adult females divided into two equal groups: Group I: Control group (n=21 normal adult females with average breast size) and group II: macromazia group (n=21). All subjects in both groups were subjected to pulmonary function test in erect and supine positions as well as arterial blood gases analysis. In control group these tests were done once, while in macromazia group tests were done twice; preoperatively and after their submission to surgery (inferiorly based reduction mammoplasty) by two months, and the results were compared and analyzed. **Results:** In this study it was found that reduction mammoplasty induced a significant improvement in some pulmonary functions as FVC (Forced Vital Capacity), FEV1/FVC (The ratio of forced expiratory volume in 1st second to forced vital capacity). However there was no significant change in FEV1 (Forced Expiratory Volume in 1st second), PEF (Peak expiratory flow rate). The improvement in pulmonary function parameters in supine position was significantly better than that occurred in erect position with a demonstrated positive correlation between weight of excised specimens from breasts and pulmonary function parameters. Moreover, reduction mammoplasty significantly increased partial oxygen tension and O_2 saturation in arterial blood with insignificant changes in, pH, Partial Co2 tension and bicarbonate level. **Conclusion:** reduction mammoplasty enhances some parameters in pulmonary function with improvement of partial oxygen tension and oxygen saturation in patients with macromazia

Key Words: reduction mammoplasty, macromazia, pulmonary functions

INTRODUCTION

Patients with breast hypertrophy or gigantomastia are suffering not only from poor cosmetic aspects of their breast but also they have multiple physical problems as neck pain, bra strap grooving, hand numbness and intertrigo which negatively affected the quality of their life, [1-3] and most of these symptoms can be alleviated by reduction mammoplasty . [4, 5]

Theoretically, heavy bulky breast can restrict chest wall movement, and reduction of this weight may lead to improvement of lung ventilation. [6] But, the effect of reduction mammoplasty on the pulmonary function, in all previous studies gives contradictory results and does not support the previous assumption. [7-10] In this work we will study the effect of reduction mammoplasty on pulmonary function, and arterial blood gases in a small trial to know how much they are correlated.

PATIENTS AND METHODS

This prospective study was conducted at plastic, chest and physiology departments, faculty of medicine, Zagazig University from August 2007 to May 2010. Forty two adult female subjects with an age range from 22 to 45 years (mean ± SD 31.5±5.95) included in this study.

The study subjects were divided into two main groups: Group I (control group), included twenty one normal adult females with average breast size, and Group II (Macromazia group), included twenty one patients with bilateral macromazia. All macromazia patients were seeking surgery to get relief from physical symptoms, and those who were seeking for cosmetic improvement with apparently small breasts were excluded

from the study. Informed consents were obtained from our patients before participation in the study and after explanation of the whole procedure to them.

Patients were subjected to thorough medical history taking, clinical examination, BMI (body mass index) calculation, X-ray evaluation, pre and postoperative photographic documentation. Patients with chronic pulmonary problem were excluded from this study, but those with acute respiratory infection (upper or lower) were allowed to participate in the program after complete subsidence of the symptoms.

Pulmonary function tests were carried out using (Datospir70 spirometer-Sibelmed, Spain) and guided by American Thoracic Society (ATS) standards [11-13] , patient were instructed not to have heavy meals two hours before tests and to wear comfortable clothes. Tests were done both at erect and supine position. Patients were asked to do multiple trials with their maximum efforts and we consider the results obtained after three plateaus as preoperative values to exclude the positive learning effect on pulmonary function results. [7] All individuals were tested for FVC (Forced Vital Capacity), FEV_1 (Forced Expiratory Volume in 1st second), PEF (Peak Expiratory Flow rate) and FEV1/FVC (The ratio of forced expiratory volume in 1st second to forced vital capacity). Arterial blood sampling was taken for analysis of the following: PaO_2, $PaCo_2$, O_2 saturation (SaO_2), Bicarbonate and pH using ABL800 FLEX analyzer (Radiometer. Denmark). Both pulmonary function test and arterial blood gases analysis were repeated again two months postoperatively in interventional group, when the wounds were completely healed to deprive the effect of pain on the function, while in control group the tests were carried once. We tried to minimize the effect of external factor on the lung function test, first we did all tests in a fixed time (9 to 11 Am) to avoid a well known diurnal variation, [14,15] and all testes were carried by the same team.

All patients in group II had bilateral reduction mammoplasty. Inferiorly based pedicle was our elected technique, as it has the lowest rate of complication in the large sized breasts. [16] The excised tissue from both breast were weighted and reported.

STATISTICAL ANALYSIS

Results were analyzed using SPSS for windows version 15 the significant level was set at 0.05. All data were expressed as mean ± SD (standard deviation)

RESULTS

All patients recovered well without mortality. In two patients there were unilateral sensory loss in the nipple (9.5%) and one patient had superficial areola necrosis (4.7%). Two patients had unilateral wound dehiscence at the intersection between transverse and vertical wound components (9.5%); both were healed successfully after conservative management as well as those who had superficial areola necrosis. The mean operative time was 208.6±26 minutes, and average hospital stay was 7.6 ±0.135 days. Mean BMI of our patient was 30.87±3.24 and 63.6% of them were obese (BMI≥30). The average weight of excised Specimens was 2348±576g.

Pulmonary function test:

Data are shown in table 1

As regard Forced vital capacity (FVC *L*) in control group, it was 3.32±0.41 and 3.26±0.45 for erect and supine positions respectively. Preoperative results in macromazia group were 3.10±0.77and 3.05±0.54 in erect and supine position respectively, and in postoperative results were 3.29±0.88 and 3.28±0.50 in erect and supine position. It was found that there was a significant improvement in FVC values in postoperatively comparing to than

preoperative state ($p<0.01$) , this improvement was not affected by position, i.e. the amount of improvement in supine position was 0.18±0.06 L which was not statistically different from 0.22±0.03 L what gained in erect position ($p>0.05$).

Forced Expiratory Volume in 1st second (FEV1 *L*) in control group was 2.61±0.58 and 2.54±0.49 for erect and supine positions respectively. In macromazia group it was 2.56±0.40 and 2.50±0.25 preoperatively and postoperatively they were 2.58±0.44 and 2.52±0.43 in erect and supine position respectively. There was no Statistical difference between preoperative and postoperative results either in erect or in supine position ($p>0.05$), i.e. neither position nor operation had an impact on FEV1.

As for FEV1/FVC (%) in control group, it was 78.61±4.65 and 77.91±3.66 for erect and supine positions respectively. Preoperatively in macromazia group it was 82.58±5.56 and 81.96±4.65, and postoperatively it was 78.41±4.35 and 77.70±4.47, in erect and supine position respectively. It was found that FEV1/FVC significantly changed after operation ($p<0.01$). Moreover amount of change was statistically better in supine position when it compared with erect one (4.26±0.05 in supine versus 4.17±0.07erect position; $p<.05$)

Regarding peak expiratory flow rate (PEF *L/s*) in control group, they stood 4.50±0.47 and 4.49±0.34 for erect and supine positions respectively. In interventional group, preoperatively they were 4.49±0.21 and 4.48±0.54 and postoperatively they were 4.49±0.89 and 4.48±0.22 in erect and supine position respectively. It was found that there was statistically insignificant difference between all groups in both positions.

Blood Gases:

Data is shown in table 2

Regarding Partial Oxygen tension (PaO_2 mmHg) in control group it was 86.75±4.31. In macromazia group, preoperatively it was 83.47±1.40 and it was 85.19±4.77 postoperatively. It was found that PaO_2 was significantly lesser in preoperative when compared with control and postoperative groups while there was no statistical difference between control and postoperative groups ($p>0.05$).

As for O_2 saturation (SaO_2 %) in control group it was 97.11±0.89. In interventional group it was 95.77±0.18 preoperatively, and it was 96.80±0.95 postoperatively, with a significant decrease in Sa O_2 percentage in preoperative group than both control and postoperative group ($p<0.05$).

In case of PH value in control group it was 7.40±0.02, but in macromazia group it was 7.40±0.03 before operation and it was 7.41±0.01 after operation, with undetected statistical significant difference between all groups($p>0.05$). Blood bicarbonate level (HCO_3 mEq/L) in control group was 23.65±0.66, and in macromazia group it was 23.45±0.46 preoperatively and 23.86±0.95 postoperatively. It was found that there were no statistical significant differences between all groups ($p>0.05$). Partial carbon dioxide tension ($PaCO_2$ mmHg) in control group was 37.75±0.23 and preoperatively in macromazia group it was 38.85±0.11 and it was 37.36±0.55 after operations, with undetected significant changes regarding the studied groups($p>0.05$).

Regarding the relationship between the degree of improvement of pulmonary functions and arterial blood gases with weight of excised specimen, the following was detected;

There was a positive correlation between weight of excised specimen and the degree of improvement in FVC in both erect and supine positions (coefficient value were

0.456 and 0.482) respectively. This significant correlation was also noticed between weight of resected specimen and degree of improvement in PaO2, saturation (SaO_2 %) postoperatively.

Also there was positive correlation demonstrated between patient's BMI and the weight of excised specimen (correlation coefficient 0.553).

Table (1) Show Pulmonary function parameters in all groups (Mean ± SD):

	Control	Macromazia		
		preoperative	Postoperative	*p*
FVC(L)				
Erect	3.32±0.41	3.10±0.77	3.29±0.88	<0.001
Supine	3.26±0.45	3.05±0.54	3.28±0.50	<0.001
FEV_1 (L)				
Erect	2.61±0.58	2.56±0.40	2.58±0.44	□0.05
Supine	2.54±0.49	2.50±0.25	2.52±0.43	□0.05
FEV1/FVC (%)				
Erect	78.61±4.65	82.58±5.56	78.41±4.35	<0.001
Supine	77.91±3.66	81.96±4.65	77.70±4.47	<0.001
PEF (L/s)				
Erect	4.50±0.47	4.49±0.21	4.49±0.89	□0.05
Supine	4.49±0.34	4.48±0.54	4.48±0.22	□0.05

Table 2 Shows Blood gases, pH and bicarbonate levels in all groups

	Control	Macromazia	
		preoperative	Postoperative
PaO_2(mmHg)	86.75±4.31	83.47±1.40	85.19±4.77
SaO_2 (%)	97.11±0.89	95.77±0.18	96.80±0.95
pH	7.40±0.02	7.40±0.03	7.41±0.01
HCO_3(	23.65±0.66	23.45±0.46	23.86±0.95
$PaCO_2$(mmHg)	37.75±0.23	38.85±0.11	37.36±0.55

Figure 1 Pre and post operative photos of one our cases

DISCUSSION

The effect of reduction mammoplasty on the pulmonary function was an issue of debate since long time. Theoretically big breast could restrict chest wall movement by its weight, [6] and the restriction should be at the maximum in recumbent position as the direction of weight lies parallel to the direction of gravity.

While some studies prove the positive effect of mammoplasty on the pulmonary function [7, 10], others deny this effect.[17] The debate extended between those who stated the beneficial effect of breast reduction surgery and how much this surgery improves the lung function and oxygen saturation, with others who had a contradictory results. **Camp and Dickson** reported immediate intra-operative improvement in O_2 saturation after breast resection and attributed this to a more chest excursion after removal of restricting weight. [18] **Cunha et al.** noticed significant improvement in both total lung capacity and residual volume after reduction mammoplasty for twelve patients with gigantomastia while other parameters of pulmonary function did not show the same significant improvement. [6] **Sood and co-workers** noticed a significant improvement in inspiratory capacity, peak expiratory flow rate, and maximal voluntary ventilation after a resection of an average of 2220grams of breast tissue, and this improvement also correlated positively with BMI. [19] **Starley et al.** reported an improvement of pulmonary function tests (PEFR,PIFR,FVC) and oxygen saturation after reduction mammoplasty by 6-8 weeks .The mean weight of excised tissue in his study was 1546 gm On the other hand **Iwuagwu** et al. found no statistical significance in parameters of pulmonary function between the patient submitted to reduction mammoplasty and a control group who submitted to respiratory physiotherapy, but a positive correlation was demonstrated between the weight of excised specimen and FEV1/VC , FVC (forced vital capacity),

FEV/FVC and PEF (peak expiratory flow rate) after surgery.

In our study the parameters of pulmonary function of all patients lied within the normal range either pre or postoperatively. The mean weight of excised specimen was 2348gm in patients with BMI ≥30. There was a significant change in FVC and FEV1/FVC postoperatively and this improvement is correlated with the weight of excised specimen which supports the hypothetical benefit of reduction mammoplasty on lung ventilation and chest wall compliance. Also there was positive correlation between resected specimen and improvement of oxygen tension and saturation; this is attributed to the more weight of excised breast tissue the better lung compliance and oxygenation

The deleterious effect of recumbent position on pulmonary function is well known [20-23] and also was shown in our study, but our unique finding is that, the improvement of lung function after surgery in recumbent position was significantly higher than the improvement found in the same parameters in erect position, which support our hypothesis. Moreover there was and also patient´s objective improvement in patients breathing pattern after surgery.

CONCLUSION

From this study it could be concluded that reduction mammoplasty enhance some parameters in pulmonary functions such as FVC, FEV_1/FVC in patients with macromazia with significant improvement in PaO2. (SaO_2 %) postoperatively

REFERENCE

1. Kerrigan CL, Collins ED, Striplin D M Kim M, Wilkins E, Cunningham B . The Health Burden of Breast Hypertrophy. Plast Reconstr Surg 2001; 108: 1591
2. Dancey A, Khan M. Dawson J, Peart F. Gigantomastia a classification and review of the literature. J Plastic Reconstructive & Aesthetic Surgery 2008; 61: 493-502
3.Collins ED, Kerrigan CL, Kim M, Lowery JC, Striplin DT, Cunningham B, Wilkins EG. The Effectiveness of Surgical and Nonsurgical Interventions in Relieving the Symptoms of Macromastia .Plast. Reconstr. Surg.2002; 109: 1556
4.Rogliani M, Gentile P, Labardi L, Donfrancesco A, Cervelli V. Improvement of physical and psychological symptoms after breast reduction. J Plast Reconstr Aesthet Surg 2009; 62(12):1647-9.
5. Gonzalez F, Walton RL, Shafer B, Matory WE Jr, Borah GL. Reduction mammaplasty improves symptoms of macromastia. Plast Reconstr Surg 1993; 91(7):1270-6.
6. Cunha MS, Santos LL, Viana AA, Bandeira NG, Limafilho JA, Meneses VL. Evaluation of pulmonary function in patients submitted to reduction mammaplasty. Rev. Col. Bras. Cir. 2011; 38(1): 011-014
7. Iwuagwu OC, Platt AJ , Stanley PW, Hart NB, Drew PJ. Does Reduction Mammaplasty Improve Lung Function Test in Women with Macromastia? Results of a Randomized Controlled Trial. plast. Reconstr. Surg 2006; 118(1): 1-6
8. Conway H, Smith J. Breast plastic surgery: reduction mammoplasty, mastopexy, augmentation mammoplasty, and mammary construction: Analysis of two hundred and forty five cases. Plast Reconstr Surg 1958; 21:8-19.
9. Goldwyn RM. Pulmonary function and bilateral reduction mammoplasty. Plast Reconstr Surg 1974; 53:84
10. Starley IF, Bryden DC, Tagari S, Mohammed P, Jones BP. An investigation into changes in lung function and the subjective medical benefits from breast reduction surgery. Br J Plast Surg 1998; 51:531-4.
11. Crapo RO, Hankinson CJ. Charfa L, Maclntyre NR, Voter KL, Wise RK. American Thoracic Society. Single breath carbon monoxide diffusing capacity (transfer factor): recommendations for a standard technique. Am Rev Respir Dis. 1987; 136:1299–1307.
12 Martin R, Macklem PT. Suggested Standardization Procedures for Closing Volume Determination (Nitrogen Method). Bethesda, Md: National Heart and Lung Institute; 1973.
13. Crapo RO, Hankinson CJ. Charfa L, Maclntyre NR, Voter KL, Wise RK. American Thoracic

Society. Standardization of spirometry: 1987 update. Am Rev Respir Dis. 1987; 136:1285–98
14. Hetzal MR. The pulmonary clock. Thorax 1981; 36:481-6
15. Medarov BI, Pavlov VA, Rossoff L. Diurnal Variations in Human Pulmonary Function. Int J Clin Exp Med 2008; 1: 267-73
16. Cardoso AD, Pessanha MC, Peralta J M. Three dermal pedicles for nipple-areolar complex movement in reduction of gigantomastia. Ann Plast Surg 1984; 12:419-27
17. Haktanır NT, Fidan F, Köken G, Demir Y, Yılmaz G, İşler S, Tüzüner M. Effects of Breast Size on Lung Function. Eur J Gen Med 2010; 7(2):150-4
18. Camp DF, Dickson MG. Perioperative improvement in lung function during reduction mammoplasty. British Journal of Plastic Surgery 1999; 52: 238–44
19. Sood R, Mount DL, Coleman JJ, Ranieri J, Sauter S, Mathur P, Thurston B. Effects of reduction mammoplasty on pulmonary function and symptoms of macromastia. Plast Reconstr Surg 2003; 111:688-94.
20. Norregaard O, Schultz P, Ostergaard A, Dahl R. Lung function and postural changes during pregnancy. Respir Med. 1989; 83:467– 70.
21. Pistelli R, Fuso L, Muzzolon R, Canfora M, Ferrante E, Ciappi G. Factors affecting variations in pulmonary diffusing capacity resulting from postural changes. Respiration. 1991; 58:233–7.
22. Craig DB. Effects of position on expiratory reserve volume of the lungs. J Appl Physiol. 1960; 15:59–61.
23. Agostini E, Hyatt RE. Static behavior of the respiratory system. In: Fenn WO,and Rahn H, eds. Handbook of Physiology, Section 3—Volume III: The Respiratory System; Part 2: Mechanics of Breathing. Baltimore, Md: Williams & Wilkins; 1986:113–130.