Original Article

Effects of Bilateral Breast Reduction on Peak Airway Pressure and Pulmonary Function Tests

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Abstract

Purpose: Surgical reduction due to breast size is not carried out merely for anesthetic concerns but also for such complaints as breast pain belonging to breast and skeletal system, back pain, neck pain, and intertriginous rashes. This study aims to investigate the effect of bilateral breast reduction surgery on maximum inspiratory pressure (Ppeak) and pulmonary functions. This study aims to investigate the effect of bilateral breast reduction surgery on pulmonary function test. **Methods:** The study included 50 patients who would undergo bilateral breast reduction. Patients were divided into two groups: group II were given positive end-expiratory pressure (PEEP), which was not administered to the group I. Patients were checked in terms of maximum inspiratory pressures (Ppeak) before surgery, after first and second breasts were removed, and after surgery. Pulmonary function tests were carried out on preoperative, postoperative second and 14th days. As RFT, forced vital capacity (FVC), FEV1 (forced expiratory volume at the first second of FVC), FEV1/FVC and PEF (peak expiratory flow rate) were measured. **Results:** In both groups, demographic data were not found to statistically significant differences ($P > 0.05$). When compared both groups in terms of preoperative FVC and FEV1/FVC 14th day, a significant increase was found on the 14th day ($P < 0.05$). A significant difference was not established between groups in terms of Ppeak values ($P > 0.05$). Ppeak was found to be significantly higher in group I (22.28 ± 7.56) at the end of intubation compared with group II (19.04 ± 3.73) ($P = 0.002$, $P < 0.05$). Similarly, preoperative Ppeak was established to be 21.88 ± 7.51 in group I and it was significantly higher compared with group II (19.44 ± 4.08), ($P = 0.002$, $P < 0.05$). When compared Ppeak values at the end of intubation and before operation with entry values a statistically significant difference was not found in either group ($P = 0.76$, $P > 0.05$). **Conclusions:** Some researchers reported a positive correlation between FVC, FEV1/FVC, and PEF along with the excised tissue mass. We established a positive correlation between the excised tissue weight and FVC and FEV1/FVC and that PEEP application did not have an impact on Ppeak.

Keywords: *Airway pressure, macromastia, respiratory function*

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Introduction

Breast reduction surgery is among the most common operations in plastic surgery. Surgical reduction due breast size is not only due to esthetic concerns but also for the reasons of such complaints as breast pain belonging to breast and skeletal system, back pain, neck pain, ptosis, and intertriginous rashes.[1-3] It was shown through various retrospective and prospective studies that the patients who went through breast reduction had

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recovered quality of life and their complaints improved significantly.[4,5]

Improvements in pulmonary parameters following breast reduction were assessed by pulmonary function tests.[6] Studies conducted by utilizing pulmonary function tests following breast reduction are scarce in number and differences were found in their results.[7,8] This study aims to investigate the effect of bilateral breast reduction on maximum inspiratory pressure and pulmonary functions. The aim of this study is to show the improvement of pulmonary function test parameters due to loss of breast tissue over thorax after breast reduction surgery.

Methods

Following the approval of the ethics committee was obtained, 50 patients between the ages of 23 and 65 who would undergo bilateral breast reduction surgery were included in the study. During the preoperative interview, patients were informed about the anesthesia to be administered and also the study. Cases with known or previous pulmonary diseases, smoking history, chest wall operation, and hepatic and cardiac failures were excluded from the study. Age, height, and weight of patients were recorded and body mass indexes (BMIs) were calculated according to weight/height square (kg/m^2). Operations were carried out by the same surgeon. Entire cases were administered 2 mg/kg fentanyl, 7 mg/kg thiopental, and 0.4 mg/kg rocuronium in their anesthesia induction. Patients belonging to group II were added 5 cm H_2O positive end-expiratory pressure: expirium end positive pressure (PEEP), and group I patients were not administered PEEP. Anesthesia maintenance was provided by 4–5% desflurane, 50% O_2, 50% N_2O, fentanyl, and rocuronium and also administered were tidal volume 8 mL/kg, respiratory counts 12/min and inspiration/expiration rates as ½. At the end of intubation, patients were checked in terms of peak inspiratory pressures (Ppeak) before surgery, after first and second breasts were removed, and after surgery. At the end of intubation, patients were checked in terms of maximum inspiratory pressures (Ppeak), hemodynamics, and peripheral oxygen saturations during anesthesia before surgery, after first and second breasts were removed, and after surgery. Excised breast tissues, first and second breast weights were recorded. Anesthesia and surgery times were recorded and intraoperative fentanyl and rocuronium amounts were also noted down. Hemodynamic measurements, anesthesia and surgery times, intraoperative drug consumptions (fentanyl and rocuronium), and weights of excised breast tissues (grams) of patients were recorded. From the pulmonary function tests (Micromedical, Rochester, Great Britain Rochester, England) FVC, FEV1, FVC/FEV1, and PEF values were measured in liter and in percent by spirometer device on preoperative and postoperative second and 14th days. Patients were first explained in detail and the test was carried out at least for once until they fully understood. Because of RFT depend on patients' effort, each time maximum of five tests were carried out consecutively and the best value was recorded.

The measured PFT values were recorded for each case in liter and in percent (%) values. Percentage values for each PFT parameter were estimated by calculated percentage value = (actual value/predicted value) × 100 formula.[9]

Statistical analyses were conducted by SPSS 10.0 software. Mann–Whitney *U* test and independent samples *t* test were used for intergroup comparisons. Intragroup comparisons carried out according to entry values were conducted by paired samples test.

Results

Preoperative measurements of 50 patients aged between 23 and 65 (mean 44.94 ± 1.11) revealed mean weights

Table 1: Demographic values of patients

	GROUP I	GROUP II	*p*
ASA	I-II	I-II	-
AGE	46.00±1139	43.88±1.106	0,763
BMI	32.92±6.654	29.86±5.719	0,135
HEIGHT	1.58±8.036	1.612±6.284	0,377
CHRONIC DISEASE (n) (hypertension, hypothyroidism, diabetes mellitus)	8/25 2 HT, 3 HT+DM, 3 hypothyroidism	9/25 2 HT+1 DM, 4 Hypothyroidism, 2DM+HT	-

ASA = American Society of Anesthesiology, BMI = body mass index

Table 2: Intraoperative values of patients

	GROUP I (no PEEP)	GROUP II (PEEP-5)	*p*
Ppeak value after the excision of first breast	21.12±6.153	19.60±4.163	0,465
Ppeak value after the excision of second breast	20.96±6.380	19.56±3,764	0,546
First excised breast tissue (gram)	951.2±3.720	670.4±3.133	0,004*
Second excised breast tissue (gram)	951.6±4.646	700.8±3.244	0,037*
Anesthesia time (minutes)	158.0±3.971	157.00±2.761	0,748
Operation time (minutes)	136.8±3.587	134.2±2.460	0,846
Intraoperative fentanyl amount (miligram)	224.0±83.06	233.0±72.42	0,486
Intraoperative rocuronium amount (miligram)	68.80±14.59	67.20±14.29	0,722

Ppeak = Peak airway pressure, PEEP = Positive end-expiratory pressure, *Statistically significant differences are indicated by asterisks ($P < 0.05$)

of 80.52 ± 1.53 kg, heights of 159 ± 7.27 cm and BMIs of 32.92 ± 6.65 in group I and 29.86 ± 5.71 kg/m2 in group II [Table 1]. In comprasions between the groups, more statistically significant first breast tissue was excised in the first group compared to the second group (951.2 ± 3.720 versus 670.40 ± 3.13, $P = 0.004$, $P < 0.05$, [Table 2]) Also, compared with second excised breast tissue size between the groups, the breast volume excised in in the first group was statistically significantly higher than the second group (951.60 ± 4.646 versus 700.80 ± 3.24, $P = 0.037$, $P < 0.05$, [Table 2]). Table 1 shows ASA, age, BMI, height, and chronic disease presence among demographic data between groups. In group I, chronic diseases were hypertension in two cases, and diabetes mellitus accompanying hypertension in three cases. In addition, three cases were established to have hypothyroidism. In group II, two hypertension patients, a single case of diabetes mellitus, and four hypothyroidisms were established. Also, in group II, hypertension accompanied diabetes mellitus in two patients. A statistically significant difference was not found in both groups in terms of demographic data ($P > 0.05$, [Table 1]). A difference was not found between groups I and II in terms of intraoperatively used fentanyl and muscle relaxant amounts ($P > 0.05$, [Table 2]).

In comparisons between the groups, Ppeak was found to be significantly higher in group I (22.28 ± 7.56) at the end of intubation compared to group II (19.04 ± 3.73)($P = 0.001$, $P < 0.05$). Similarly, preoperative Ppeak was established to be 21.88 ± 7.51 in group I and it was significantly higher compared to group II (19.44 ± 4.08), ($P = 0.002$, $P < 0,05$, [Table 1]). When compared Ppeak values at the end of intubation and before operation with entry values a statistically significant difference was not found in either group ($P = 0.76$, $P > 0.05$).

There were no statistically significant differences between the groups in terms of preoperative, postoperative 2nd day, and 14th day respiratory function tests. Changes in pulmonary function tests before and after operation in group I were not statistically significant [Table 3]. In group II, however, FEV1 (Lt) ($P = 0.001$), FEV(%) ($P = 0.001$), FVC(%) ($P = 0.002$) FVC(Lt) ($P = 0.001$), PEF(ıt/min) ($P = 0.018$) and PEF(%) ($P = 0.002$) decreased statistically significantly when compared with the preoperative period and increased to preoperative values on postoperative 14th day [($P < 0.05$), Table 4]. In our study, airway peak pressures were recorded before and after excision of breast tissue. Preoperative peak airway pressure was recorded as 21.88 ± 7.51 cm H_2O in group I and as 19.44 ± 4.08 cm H_2O in group II. Pressure values recorded following breast surgery were observed to be 21.52 ± 6.85 cm H_2O in group I and 20.04 ± 4.56 cm H_2O in group II. A statistically significant difference was not found in either group in airway pressure (Ppeak) measurements before and after breast surgery ($P = 0.76$, $P > 0.05$).

Table 3: Pulmonary function values following breast reduction in Group I

	Preoperative	Postoperative 2nd day	Postoperative 14th day	*p*
FVC (Lt)	271.4±62,53	258.9±51,65	272.5±48.12	0,372
FVC (%)	91,72±14.46	87,76±10.34	93.48±13.02	0,669
FEV1 (Lt)	229.4±48.94	224.0±47.15	235.1±44.15	0,073
FEV1 (%)	91.32±11.49	88.20±11.46	94.64±10.68	0,256
FEV1/FVC (lt)	85.84±6.54	86.96±9.554	90.00±13.20	0,307
FEV1/FVC %	105.9±12.31	104.8±11.66	104.1±10.01	0,197
PEF (lt/min)	293.2±1.37	270.9±97.74	314.6±113.3	0,067
PEF %	70.24±20.44	68.92±23,12	79.92±22.00	0,093

FVC = forced vital capacity, FEV1 = forced expiratory volume in 1 second , PEF = peak expiratory flow, *P* values

Table 4: Pulmonary function values following breast reduction in Group II

	Preoperative	Postoperative 2nd day	Postoperative 14th day	*p*
FVC (Lt)	290.4±57,64	267.5±60,27*	287.5±44.61	0,001*
FVC (%)	92.84±13.36	88.20±4.92*	93.08±10.69	0,002*
FEV1 (Lt)	255.8±44.07	236.7±39.10*	255.5±38.74	0,001*
FEV1 (%)	96.24±12.43	90.60±14.01*	96.32±11.83	0,001*
FEV1/FVC (lt)	87.60±8.727	88.16±8.117	88.80±4.966	0,818
FEV1/FVC %	110.2±9.800	109.48±10.49	109.1±6.313	0,347
PEF (lt/min)	369.9±1.55	321.4±120.9	345.7±91.90	0,018*
PEF %	79.04±16.61	74.68±17.16	85.60±12.57	0,002*

FVC = forced vital capacity, FEV1 = forced expiratory volume in 1 second, PEF = peak expiratory flow, statistically significant

Discussion

There are limited number of studies on pulmonary mechanics and pulmonary function changes in patients that underwent bilateral breast surgery. In a study conducted on breast reduction and pulmonary functions, BMI was found to have negative correlation with FEV1, FVC, and FEV1/FVC and that there was no correlation between breast size and such parameters concerning obesity, macromastia causes a partial decrease in chest wall compliance. A decrease in breast size was considered to increase chest wall compliance.[3] Conway and Smith[10] conducted one of the very first studies on this issue and reported that there was a relief in respiration thanks to the increase in chest wall compliance following breast reduction.

Our study evaluated peak airway pressures during breast reduction operations. In addition, postoperative FVC, FEV1, FEV1/FVC, and PEF values were compared.

PFTs that are subjective measures were used in later studies on the issue. Expressions of PFTs are as follows: Forced vital capacity (FVC) is an important test in assessing ventilatory capacity. It is the volume of air exhaled with the fastest possible expiration following maximum inhalation. The test should have a sudden start and without the presence of cough at the time. It is expressed in liter (L). Despite essentially pointing to restrictive pulmonary disease, reduction in FVC also occurs during restriction or congestion in airways. Forced expiratory volume (FEV1) at the first second of FVC is the air volume exhaled in one second with the start of FVC maneuver. Its variability in healthy individuals is 60–270 mL. It generally reflects large airways and is significant for disorders in the area. FEV1 is reduced by airway obstruction (mucus secretion, bronchospasm, inflammation). In restrictive pathologies, it decreases depending on the reduction in FVC. Rate of FEV1 to FVC is FEV1/FVC. Forced expiratory flow rate ranging 25–75% of FVC volume is expressed as FEF 25–75%, and peak expiratory flow rate is PEF. PEF is the maximal flow rate obtained during deep expiration following deep inspiration. It shows the function of large airways. FEF 25–75% is significant in diseases of small bronchi and large bronchioles. Decrease in FEV1 and FEV1/FVC parameters brings to mind obstructive airways disease.

In a study by Goldwyn, no changes were found in pulmonary functions before and after breast resection (mean resection weight, 1.980 g).[11]

Marcelo *et al.* observed 12 patients aged 18–42, with mean BMI values of 26.83 and with resected mean breast weight of 1.525 g that would undergo operation preoperatively and postoperatively for 3–6 months. During anesthesia, patients were ventilated by tidal volume 10 mL/kg and PEEP 5 mmHg. Consequently, total pulmonary capacity and pulmonary residual volumes of patients increased significantly and were found to have better pulmonary functions.[12] We checked the Ppeaks of patients from the second group by administering PEEP 5 mmHg and tidal volume 7 mL/kg during anesthesia. We established that the administration of PEEP did not have an effect on Ppeak pressures. Breasts with bigger sizes and higher volumes were reported to cause restricted movement of chest wall.[12]

Sood *et al.*[4] found statistically significant changes on objective pulmonary criteria such as inspiratory capacity, peak expiratory flow rate, and maximal voluntary ventilation after mean weight 1.220 g resected breast tissue. They found also these changes correlated with body mass index. In our study, we did not find a statistically significant change in PEF rate.

Iwuagwu *et al.*[8] did not find statistical significance in the said parameters in 73 patients with resected breast tissue mean weight of 1.381 g; however, they found positive correlation. In our study, a significant difference was not found in Ppeaks following the resection of first and second breasts ($P > 0.05$, [Table 1]).

Studies investigating the effect of breast reduction on pulmonary function are low in number. Varying results were reported from these studies.

Conclusions

In the present study, no statistically significant difference was found regarding breast tissue weight excised following breast reduction and PFTs between the groups. However, patients expressed a relief in their respiration.

The different results in pulmonary functions and breast reduction surgery have been reported in many studies. However, controlled studies with a high number of patients are still needed for a valid evaluation.

Consequently, relief in their respiration and improvement of pain complaint are significant benefits for patient's life comfort.

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Conflicts of interest

There are no conflicts of interest.

References

1. Ferreira MC, Costa MP, Cunha MS, Sakae E, Fels KW. Sensibility of the breast after reduction mammaplasty. Ann Plast Surg 2003;51:1-5.

2. Foreman KB, Dibble LE, Droge J, Carson R, Rockwell WB. The impact of breast reduction surgery on low-back compressive forces and function in individuals with macromastia. Plast Reconstr Surg 2009;124:1393-9.
3. Haktanır-Turhan N, Fidan F, Koken G, Demir Y, Yımaz G, Isler S, Tuzuner M. Effects of breast size on lung function. Eur J Gen Med 2010;7:150-4.
4. Sood R, Mount DL, Coleman JJ, Ranieri J, Sauter S, Mathur P, *et al.* Effects of reduction mamamoplasty on pulmonary function and symptoms of macromastia. Plast Reconstr Surg 2003;111:688-94.
5. Davis GM, Ringler SL, Short K, Sherrick D, Bengtson BP. Reduction mammaplasty: Long-term efficacy, morbidity and patient satisfaction. Plast Reconstr Surg 1995;96:1106-10.
6. Bartu S, Pulmonary Function Test, Turkish Thoracic Society, Winter School 2007;31.
7. Conway H, Smith J. Breast plastic surgery: reduction mammaplasty and mamary construction: Analysis of two hundred and forty five cases. Plast Reconstr Surg 1958;21:8.
8. 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.
9. Madama VC. Test for pulmonary mechanics. In: Madama VC, editor. Pulmonary function testing and cardiopulmonary stress testing. 2nd ed. Albany, NY: Delmar Publishers; 1998. p. 30.
10. Conway H, Smith J. Breast plastic surgery: Reduction mammaplasty, mastopoxy, augmentation mammaplasty, and mammary construction: Analysis of two hundred and forty five cases. Plast Reconstr Surg 1958;21:8-19.
11. Goldwyn RM. Pulmonary function and bilateral reduction mammoplasty. Plast Reconstr Surg 1974;53:84.
12. Cunha MS, Santos LL, Viana AA, Bandeira NG, Filho JAL, Meneses JAL. Evaluation of pulmonary function in patients submitted to reduction mammaplasty. Rev Col Bras Cir 2011;38:1.