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Evaluation of post-surgical respiratory functions of patients who underwent sleeve gastrectomy

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ABSTRACT

Introduction: This study aimed to investigate the changes in respiratory functions of patients who underwent sleeve gastrectomy (SG) compared to the pre-operative period.

Materials and Methods: In our study, the pre- and post-operative data of 132 patients who underwent SG for obesity between March 2018 and March 2021 were retrospectively scanned. Post-operative pulmonary function tests and body mass indexes (BMI) at the 3rd, 6th, and 12th month were evaluated.

Results: Of the patients, 99 (75%) were female, 33 were male (25%), and the mean age was 35.6±10.7 (18–63). Pre-operative mean forced expiratory volume in the 1 second of forced was 2.5±0.8. The mean air volume exhaled in the 1 second of forced expiration measured at post-operative 3, 6, and 12 months were 2.5 ± 0.6, 2.5±0.7, and 2.9±0.7, respectively. The mean air volume exhaled in the first second of forced expiration measured at post-operative 3, 6, and 12 months/forced vital capacity (VC) values was 89.6±7.5; 89.8±8.3, and 89.8±8.8, respectively. While the air volume/forced VC values in the 1 second of the forced expiration measured at the post-operative 3rd, 6th, and 12th month were not statistically significant when compared with the pre-operative values, the improvement in the air volume values in the 1 second of the mean forced expiration at the post-operative 12th month was statistically significant when compared with the pre-operative values (p=0.03). When the mean BMI values at the post-operative 3rd, 6th, and 12th month were compared with the pre-operative values, it was observed that all three values were significantly lower (p<0.001).

Conclusion: In our study, to evaluate airflow limitation, the pre-operative mean air volume exhaled in the 1 second of forced expiration was calculated as 2.5±0.8. The values were re-evaluated at 3rd, 6th, and 12th month postoperatively. While there was no significant difference in the values of the air volume exhaled in the 1 second of the forced expiration compared to the pre-operative period in the post-operative 3rd and 6th month, a significant improvement was found in the values of the air volume exhaled in the 1 second of the forced expiration in the post-operative 12th month of the cases compared to the pre-operative period.

Keywords: Obesity, Pulmonary function test, Sleeve gastrectomy

Introduction

Obesity is considered as a chronic disease that directly affects life expectancy and quality among preventable diseases that cause death.[1,2] Obesity is not just a weight issue. Decreased pulmonary functions in obese patients and the increasing prevalence of pulmonary diseases increase the severity of the condition of these patients and lead to a decrease in lung compliance.[3-6] Fat accumula-

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tion in the thoracic and abdominal areas in obese individuals increases the stiffness of the thoracic wall, elevates the diaphragm, and increases the pressure on the lungs leading to restriction in pulmonary functions.[7-9] Overweight or weight gain are associated with decreased lung volumes and pulmonary dysfunction.[10] Total lung capacity (TLC) and residual volume (RV) decrease in obesity. Weight gain also tends to be accompanied by a decrease in vital capacity (VC), and the volume of air exhaled in the 1 second of forced expiration (FEV1) is likely attributable to the effect of excess fat mass on the chest wall and lung compliance. One of the most consistent effects of obesity on lung volumes is a decrease in expiratory reserve volume (ERV).[11,12] ERV decreases as body mass index (BMI) increases. Postural changes are known to affect normal lung volumes due to the gravitational effects of abdominal contents on the position of the diaphragm. Data from a longitudinal evaluation of postural changes in lung volumes in morbidly obese individuals following weight loss are scarce. Conversely, weight loss is associated with improved respiratory function.[13,14]

In some studies, it was shown that weight loss triggers an increase in physical activity and significantly improves pulmonary functions and comorbidities.[15] It was reported that laparoscopic bariatric procedures enable patients to return to their normal lives in the early period and positively affect their pulmonary functions.[16]

In this study, we aimed to investigate the level of improvement in pulmonary respiratory functions of patients who underwent sleeve gastrectomy (SG) for obesity, with pre- and post-operative pulmonary function tests and weight loss.

Materials and Methods

Age, gender, BMI, and SFT results of 132 patients who underwent SG surgery due to obesity between March 2018 and March 2021 in our clinic were retrospectively scanned through files and computers. Patients with a BMI of 35 kg/m² and above, patients with comorbidities such as hypertension, diabetes mellitus, and sleep apnea, and patients with a BMI of 40 kg/m² and above were included in the study. Before the surgery, all patients were consulted to psychiatry, chest diseases, cardiology, internal medicine, or endocrinology clinics. An informed consent form was obtained from the patient and/or relatives for the surgical intervention to be performed. Age, gender, and PFT data of the patients at the 3rd, 6th, and 12th month of the post-operative period were recorded. Respiratory functions were measured with a spirometry device while the patients were in the sitting position (PFT 2450 system; Spire, Zan). FEV1, forced VC (FVC), and FEV1/FVC were measured.

Statistical Analysis

Statistical data were analyzed using SPSS version 24.0 (SPSS Inc., Chicago, IL) package program. Descriptive statistics were summarized as the number, percentage, mean, and standard deviation. Analysis of continuous variables was performed using the appropriate Student-t-test and Mann–Whitney U-test, considering the distribution and homogeneity of the data. The significance level was accepted as $P<0.05$ in all statistical analyzes.

Results

One hundred and thirty-two patients who underwent SG surgery for morbid obesity between March 2018 and March 2021 were included in the study. There were 99 females (75%) and 33 males (25%) in the study group, with a mean age of 35.6±10.7 (18–63). The pre-operative mean FEV1 value was 2.5±0.8. The mean FEV1 values measured at the post-operative 3rd, 6th, and 12th month were 2.5±0.6; 2.5±0.7, and 2.9±0.7, respectively. When compared with the pre-operative mean FEV1 values, no significant difference was observed in the 3rd- and 6th-month values (P=0.51, P=0.508), while a statistically significant improvement was found in the mean FEV1 values measured at the 12th month (P=0.037). The pre-operative mean FEV1/FVC value was 90.5±7. The mean FEV1/FVC values at post-operative 3, 6, and 12 months were 89.6±7.5; 89.8±8.3, and 89.8±8.8, respectively; and no significant difference was observed when compared with pre-operative values (P=0.267, P=0.370, P=0.273).

The pre-operative mean BMI value was 46.7±6.8. The mean BMI values measured at the 3rd, 6th, and 12th month postoperatively were 38.8±6.2; 34.6±5.5; 29.1±4.8, respectively, and it was observed that there was a statistically significant decrease in all three values compared to the pre-operative values ($P<0.001$) (Table 1).

Discussion

It is important to reveal the presence of limited pulmonary function tests and even sleep apnea syndrome during sleep in patients who are candidates for bariatric

Table 1. BMI, FEV1, and FEV1/FVC values of the patients

Variables	Pre-operative	Post-operative 3rd month	Post-operative 6th month	Post-operative 12th month
FEV1	2.5±0.8	2.5±0.6	2.5±0.7	2.9±0.7
FEV1/FVC	90.5±7	89.6±7.5	89.8±8.3	89.8±8.8
BMI	46.7±6.8	38.8±6.2	34.6±5.5	29.1±4.8

BMI: Body mass index; FEV1: Volume of air exhaled in 1 second of forced expiration; FVC: Forced vital capacity; FEV1/FVC: Volume of air exhaled in 1 second of mean forced expiration/forced vital capacity; Pre-op: Preoperative; Post-op: Postoperative.

surgery, to evaluate the recovery in the post-operative period, and to predict the complications that may occur. Fat accumulation in the abdominal and thoracic cavities and the mediastinal region directly affects the mechanical properties of the lung and chest wall. Fat accumulation causes the diaphragm to rise and limits the downward movement required in respiratory mechanics, increasing pleural pressure and causing a decrease in functional residual capacity (FRC). This decrease is 10% for overweight, 22% for obese, and 33% for severely obese.[17] While bariatric surgery aims to solve Type 2 diabetes and other obesity-related comorbidities, it also aims to improve respiratory functions and sleep apnea in addition to its primary goals. In obese patients, the work of breathing increases and the lung volume decreases, which causes respiratory muscle dysfunction, impaired gas exchange, and decreased exercise tolerance.[18,19] It can be said that musculoskeletal functions are restricted due to the increased BMI, but the exercise tolerance of the patients begins to increase during the weight loss process. According to the European Chapter (IFSO-EC) and the European Association for the Study of Obesity (EASO), bariatric surgery is recommended when a BMI is ≥40 kg/m^2 or BMI is 35–40 kg/m^2 and surgical weight loss is expected with concomitant diseases.[20-23]

Young et al.[24] stated that male obesity rates now equate to female obesity rates. However, men constitute the minority of patients undergoing bariatric surgery. Our study group consisted of 99 women (75%) and 33 men (25%), and the mean age was 35.6±10.7 (18–63). These data were compatible with the literature.

In the Hewitt study,[25] it was reported that 5 years after the operation, the FEV1 value increased by 4.1% in women and 6.7% in men, while the FVC value increased by 5.8% in women and 7.6% in men. In our study, no significant difference was observed between the mean FEV1 values before the operation and the mean FEV1 values at the 3rd and 6th month after the operation (P=0.511, P=0.508), we found that there was a statistically significant improvement in the mean FEV1 values at the 12th month compared to the pre-operative period (P=0.511, P=0.508). P=0.037). Our results were found to be compatible with the literature.

In the study of Okur et al.[26] in which female patients were included alone, no difference was found between FEV1/FVC values in the pre-operative and post-operative periods. Zarabe et al.[27] found an increase in TLC, FEV1, and FVC in 36 morbidly obese patients 6 months after bariatric surgery. In our study, when the mean FEV1/FVC values were compared with the pre-operative values, no significant difference was observed in the post-operative values. These results were found to be compatible with the literature.

There were some limitations in our study, such as the small number of patients and the fact that we could only evaluate the 1-year post-operative period. Therefore, we think that studies with more patients in which additional parameters can be examined will reveal the positive effects of bariatric surgery on respiratory functions.

Disclosures

Ethichs Committee Approval: Retrospective study.

Peer-review: Externally peer-reviewed.

Conflict of Interest: None declared.

Authorship Contributions: Concept – H.E.; Design – H.E.; Supervision – F.C.; Materials – H.E.; Data collection and/or processing – K.K.; Analysis and/ or interpretation – H.E.; Literature search – F.C.; Writing – K.K.; Critical review – K.K.

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