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The effect of weight loss and reflux on quality of life after sleeve gastrectomy

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ABSTRACT

Introduction: Sleeve gastrectomy (SG) is the most frequently performed bariatric surgery in recent years. The primary outcomes expected from bariatric and metabolic surgeries include weight loss, improvement in comorbidities, and increased quality of life (QoL). In this context, the objective of this study is to evaluate the effect of weight loss rates and symptomatic reflux on QoL.

Materials and Methods: The study sample comprised 86 patients who underwent laparoscopic SG (LSG) between January 2017 and January 2018. Patients' demographic characteristics were obtained from hospital records. The effects of excess weight loss rates and symptomatic reflux development on patients' QoL were evaluated with the 36-Item Short Form Health Survey (SF-36) in the 4th year of follow-up.

Results: The median excess weight loss (EWL) was 88.5%, and post-operative weight gain (min. 4.0–max. 18.0 kg) was detected in 26 (30.2%) patients. Reflux was detected in 22 (25.6%) patients. There was a significant correlation between patients' EWL values and their age and pre-operative body mass index values in the negative direction. In addition, there were significant correlations between EWL values and SF-36's role limitations due to physical health problems ($r=0.425$, $p<0.001$) and general health perceptions ($r=0.280$, $p=0.009$) subscale scores in the positive direction. SF-36's role limitations due to physical health problems, general health perceptions, and perceived change in health subscale scores were significantly lower in patients with reflux than those without reflux.

Conclusion: The study findings indicated that low EWL and symptomatic reflux after LSG adversely affect the QoL.

Keywords: Quality of life, Reflux, Sleeve gastrectomy, Weight loss

Introduction

Obesity and obesity-related diseases are increasing in the world with each passing day. The prevalence of obesity in adults in Turkey was reported as 36% in a study published in 2015.[1] The superiority of bariatric and metabolic surgery to conservative treatment modalities in the treatment of obesity has been proven.[2]

According to a study published by the International Federation for the Surgery of Obesity and Metabolic Disorders in 2018, the most frequently performed surgical bariatric/metabolic procedure in 2016 was laparoscopic sleeve gastrectomy (LSG) (53.6%), followed by Roux-en-Y gastric bypass (RYGB) (30.1%), and one anastomosis gastric bypass

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(4.8%).[3] LSG was first defined as a part of biliopancreatic diversion surgeries in 2004 and has been accepted as a stand-alone bariatric surgical procedure since then.[4]

The primary success criteria of bariatric surgery are weight loss, improvement or recovery in comorbidities, and, most importantly, a positive change in the quality of life (QoL).[5]

The issues of reflux and weight gain are still under discussion in the context of the long-term results of LSG. In general, a fair amount of weight loss is observed in the early postoperative period, whereas weight gains are reported over the years.[6,7] In parallel, Himpens et al. determined that the excess weight loss (EWL) rate, which was 77.5% 3 years after the surgery, decreased to 59% 6 years after the surgery.[6] Another study reported that 59% of patients with or without conversion had regained 10 kg or more after 10 years of follow-up.[7]

Another complication commonly observed after LSG, in addition to weight regain, is reflux. Reflux is a condition that reduces QoL, requires long-term drug use, and sometimes conversion surgery. DuPree et al. detected reflux in 8.6% of the patients over a 3-year follow-up period, whereas Boza et al. detected reflux in 26.7% of the patients over a 5-year follow-up period.[8,9]

The primary factor that drives patients to undergo bariatric surgery is the expectation of having a better QoL afterward.[10] Given that LSG is a newer procedure compared to other surgical procedures, a complete standardization could not be achieved to date, and thus, metabolic and QoL results vary between different surgical teams. [11] In parallel, the literature data on the effect of LSG on patients' QoL compared to other relevant surgical procedures are contradictory. While some studies reported that LSG was as effective as RYGB in terms of QoL, others reported that LSG provided a less than desirable QoL.[12,13]

Change in QoL after LSG and the factors affecting this change are still being researched. In this context, the objective of this study is to evaluate the effect of weight loss rates and symptomatic reflux on the QoL of patients who underwent LSG.

Materials and Methods

The study population consisted of 126 patients who underwent LSG in the hospital where this study was conducted between January 2017 and January 2018. LSG was not preferred in patients with pre-operative reflux. Patients aged 18–65 years with a body mass index (BMI) value of >40 or >35 if obesity-related diseases such as type 2 diabetes mellitus (DM) and obstructive sleep apnea syndrome and who agreed to participate in the study were included in the study. Patients who underwent conversion due to weight gain or reflux and did not accept taking the 36-item short form health survey (SF-36), which was used to assess overall health quality, were excluded from the study. In the end, 86 patients, who could be reached and agreed to take the survey, were included in the study sample. The effects of weight loss rates and post-operative reflux on the QoL of these patients were investigated in the 4th year of their follow-ups. The study protocol was approved by the Haydarpaşa Numune Training and Research Hospital Ethics Committee (Approval No: HNEAH-KAEK 2021/261). Patients' consent was obtained prior to the study. The pre-operative demographic characteristics of the patients were obtained from the hospital records.

SF-36

The SF-36 is a general health status survey developed to assess physical and mental health in various medical conditions.[10] SF-36 consists of 36 items about QoL, which are categorized into eight subscales, that is, physical functioning, role limitations due to physical health problems, role limitations due to emotional problems, energy/fatigue, emotional well-being, social functioning, bodily pain, general health perceptions, and a single item that provides an indication of perceived change in health. SF-36 is scored between 0 and 100. The higher the overall score, the better the QoL.[14]

Obesity has been associated with lower SF-36 scores, particularly in the SF-36 subscales related to physical health. SF-36 scores reportedly improve after bariatric surgery. Therefore, SF-36 is deemed an appropriate questionnaire to evaluate QoL in patients who underwent bariatric surgery.[15]

SF-36 was translated into Turkish, applied to different patient groups as such, and validated as a result.[16]

Statistical Analysis

The descriptive statistics obtained from the research data were tabulated as *mean±standard deviation values* in the case of continuous (numerical) variables determined to conform to the normal distribution, as *median and minimum and maximum values* in the case of continuous (numerical) variables determined not to conform to the nor-

mal distribution, and as *numbers and percentage values* in the case of categorical variables. Normal distribution characteristics of the numerical variables were checked with *Shapiro-Wilk, Kolmogorov-Smirnov, and Anderson-Darling* tests.

In the comparison of differences between categorical variables according to groups, *Pearson's Chi-squared test and Fisher's exact test* were used in 2×2 tables with five or more expected cells and with less than 5 expected cells, respectively, and the *Fisher-Freeman-Halton test* was used in RxC tables with less than 5 expected cells.

In addition, in the comparisons of more than 2 independent groups, the *one-way analysis of variance (ANOVA)* test and the *Kruskal-Wallis H test* were used in the case of numerical variables determined to conform to the normal distribution and in the case of numerical variables determined not to conform to the normal distribution, respectively.

Differences determined between the groups by parametric tests were evaluated with either the *Games-Howell test or the Tukey's test*, depending on the homogeneity of variances, whereas the differences determined between the groups by non-parametric tests were evaluated with the *Dwass-Steel-Critchlow-Fligner* test.

Spearman's rho correlation coefficient was used in examining the relationships between numerical variables in cases where they were determined not to conform to the normal distribution.

Jamovi project 2.2.5.0 (Jamovi, version 2.2.5.0, 2022, retrieved from https://www.jamovi.org) and *JASP 0.16.1* (Jeffreys' Amazing Statistics Program, version 0.16.1, 2022, retrieved from https://jasp-stats.org) software packages were used in the statistical analyses. P≤0.5 was deemed to indicate statistical significance.

Results

The mean age of the 86 patients included in the study sample was calculated as 39.8±11.5 years. Approximately three-quarters (74.4%) of the patients were female. The median BMI value of the patients was 46.3 kg/m^2. Of the 86 patients, 31 (36%) had at least one comorbidity. Hypertension (HT) and obstructive sleep apnea syndrome (OSAS), which were detected in 15 (17.4%) patients, were the two most common comorbidities (Table 1).

The post-operative median BMI value was 27.4 kg/m^2. The median value of the change in BMI values was -39.6% (min. – 52.6% and max. – 14.8%). Although the median EWL rate was 88.5%, post-operative weight gain (min. 4.0-max.18.0 kg) was detected in 26 (30.2%) patients. There were post-operative improvement and recovery in the comorbidities of 26 (83.9%) and 5 (16.1%) patients, respectively. Reflux was detected in 22 (25.6%) patients. Post-operative changes in the study group are shown in Table 2.

Table 1. Demographic and clinical characteristics of the patients

	Study group (n=86)
Age (Years)†	39.8±11.5
§	38.0 (21.0–65.0)
Gender‡	
Male	22 (25.6)
Female	64 (74.4)
Pre-operative body weight (kg)§	127.0 (98.0–190.0)
Pre-operative BMI (kg/m^2)§	46.3 (40.0–64.2)
Comorbidities, yes‡	31 (36.0)
Hypertension, yes	15 (17.4)
Obstructive sleep apnea syndrome, yes	15 (17.4)
Diabetes mellitus, yes	5 (5.8)
Asthma, yes	1 (1.2)
Arthralgia, yes	1 (1.2)
Lumbalgia, yes	1 (1.2)

‡: n (%); †: Mean±standard deviation; §: Mean (min-max); BMI: Body mass index.

Table 2. Changes in the post-operative clinical characteristics of the patients

	Study group (n=86)
Current body weight (kg)§	78.0 (53.0–128.0)
Current BMI (kg/m^2)§	27.4 (21.3–43.2)
Change in BMI (%)§	−39.6 (−52.6−−14.8)
EWL (%)§	88.5 (32.6–123.0)
Weight regain, yes‡	26 (30.2)
Amount of weight regained (kg)§	9.0 (4.0–18.0)
Effect of surgery on comorbidities‡	
Improvement	26 (83.9)
Recovery	5 (16.1)
Reflux, yes ‡	22 (25.6)

†: Mean±standard deviation; §: Mean (min-max); BMI: Body mass index; EWL: Excess weight loss.

The correlation analysis revealed a significant negative correlation between the age of the patients and their EWL values (r=−0.411, p<0.001). In addition, there were significant correlations between EWL values and SF-36's role limitations due to physical health problems (r=0.425, p<0.001) and general health perceptions (r=0.280, p=0.009) subscale scores, in the positive direction (Table 3).

The interquartile range (IQR) values of the EWL rates of the patients in the study group were found to be 70.9 (IQR 25), 88.5 (IQR 50), and 95.9 (IQR 75). Accordingly, patients were divided into three subgroups: The group of patients with an EWL rate of ≤70.9 (Group 1), the group of patients with an EWL rate of >70.9 and ≤88.5 (Group 2), and the group of patients with an EWL rate >88.5 (Group 3). There were significant differences between Groups 1, 2, and 3 and the demographic characteristics of the patients. Accordingly, patients with an EWL rate of ≤70.9 were significantly older than those in Groups 1 and 2 (p=0.002 and p=0.016, respectively). There was also a significant difference between Groups 1 and 2 in terms of age (p=0.011). Pre-operative BMI values in Group 1 were significantly higher than in Group 3 (p=0.040). There was no significant difference between the groups in terms of gender (Table 4).

A comparison of the EWL groups in terms of SF-36

Table 3. Correlation analysis between EWL and age and the subscales of the SF-36

	EWL (%)	
	r	p
Age	−0.411	**<0.001**
Physical functioning	0.150	0.167
Role limitations due to physical health problems	0.425	**<0.001**
Role limitations due to emotional problems	0.128	0.240
Energy/fatigue	0.095	0.382
Emotional well-being	0.011	0.917
Social functioning	−0.005	0.962
Bodily pain	0.105	0.336
General health perceptions	0.153	0.161
Perceived change in health	0.280	**0.009**

Spearman's rho correlation coefficients, SF-36: 36-item short form health survey, EWL: Excess weight loss.

Table 4. Comparison of groups in terms of demographic characteristics based on the interquartile analysis of EWL values

	Study groups				p
	EWL ≤70.9 (n=22)	EWL 70.9–88.5 (n=21)	EWL 88.5–95.9 (n=23)	EWL >95.9 (n=20)	
Age (years)†	45.8±10.7	43.9±11.0	33.8±9.7	35.6±10.5	
§	49.5 (26.0–63.0)	46.0 (21.0–65.0)	30.0 (23.0–63.0)	35.0 (22.0–53.0)	<0.001**
Gender‡					
Male	7 (31.8)	8 (38.1)	3 (13.0)	4 (20.0)	0.221*
Female	15 (68.2)	13 (61.9)	20 (87.0)	16 (80.0)	
Pre-operative BMI §	46.7 (41.5–64.2)	49.3 (40.4–60.4)	43.9 (40.0–57.0)	43.8 (40.4–53.5)	0.010**

‡: n (%); †: Mean±standard deviation; §: Mean (min-max); *Pearson's Chi-square or Fisher-Freeman-Halton test; **Kruskal–Wallis H test. Dwass-Steel-Critchlow-Fligner test for pairwise comparisons. BMI: Body mass index; EWL: Excess weight loss.

subscale scores revealed that the median value of the role limitations due to physical health problems subscale score was significantly lower in Group 1 than in Group 2 and 3 (p=0.016 and p<0.001, respectively) (Table 5).

SF-36's role limitations due to physical health problems, general health perceptions, and perceived change in health subscale scores were significantly lower in patients with reflux than those without reflux (p=0.003, p=0.020, and p=0.009, respectively) (Table 6).

Table 5. The correlations between EWL groups and SF-36 subscale scores

	Groups				p*
	EWL ≤70.9 (n=22)	EWL 70.9–88.5 (n=21)	EWL 88.5–95.9 (n=23)	EWL >95.9 (n=20)	
Physical functioning §	95.0 (50.0–100.0)	95.0 (70.0–100.0)	100.0 (55.0–100.0)	100.0 (65.0–100.0)	0.608
Role limitations due to physical health problems §	75.0 (0.0–100.0)	100.0 (75.0–100.0)	100.0 (25.0–100.0)	100.0 (50.0–100.0)	<0.001
Role limitations due to emotional problems §	83.3 (0.0–100.0)	100.0 (33.3–100.0)	66.7 (0.0–100.0)	100.0 (0.0–100.0)	0.478
Energy/fatigue §	75.0 (5.0–100.0)	70.0 (35.0–100.0)	75.0 (10.0–100.0)	75.0 (20.0–100.0)	0.874
Emotional well-being §	78.0 (28.0–100.0)	72.0 (24.0–96.0)	72.0 (32.0–100.0)	78.0 (24.0–96.0)	0.940
Social functioning §	93.8 (12.5–100.0)	87.5 (37.5–100.0)	87.5 (12.5–100.0)	87.5 (37.5–100.0)	0.921
Bodily pain §	85.0 (12.5–100.0)	100.0 (55.0–100.0)	100.0 (32.5–100.0)	90.0 (45.0–100.0)	0.477
General health perceptions §	72.5 (10.0–100.0)	80.0 (30.0–100.0)	80.0 (25.0–100.0)	80.0 (40.0–100.0)	0.734
Perceived change in health §	75.0 (25.0–100.0)	100.0 (25.0–100.0)	100.0 (25.0–100.0)	100.0 (75.0–100.0)	0.090

§: Median (min-max); *Kruskal–Wallis H test; Dwass-Steel-Critchlow-Fligner test for pairwise comparisons.

Discussion

The worldwide prevalence of overweight and obesity has doubled since 1980, and about one-third of the world's population is now categorized as overweight or obese.[17] Obesity is reportedly associated with an increased number of unhealthy days due to physical or mental problems and decreased QoL.[15]

Weight loss alone is not a sufficient measure of bariatric surgery success. Patient satisfaction and QoL parameters are increasingly used today to measure the success of bariatric surgeries. The very first study published on patient satisfaction after bariatric surgery explained QoL, improvement in health status, increased self-confidence, and better social relations as the primary criteria for use in the assessment of bariatric surgery success.[18]

Obesity increases the risk of metabolic, cardiovascular, and musculoskeletal diseases, depression, and cancer and decreases the QoL.[19] The weight loss achieved with bariatric surgery has reportedly resulted in improvement or recovery in comorbidities.[20] Bobowicz et al. reported 28.6%, 27.8%, 100%, and 11.1% improvement in HT, Type 2 DM, OSAS, and osteoarthritis 1 year after LSG, respectively.[21] In addition, it has been reported that the improvement or recovery achieved in these diseases as a result of LSG also increases the QoL.[22]

In comparison, post-operative improvement and recovery in the comorbidities were detected in 26 (83.9%) and 5 (16.1%) patients included in this study, respectively. In line with the literature data, the highest rate of improvement among the comorbidities was achieved in OSAS. In this context, it was estimated that the most significant contribution to the improvement in QoL has come from the high improvement rate in OSAS.

Weight loss is the first goal in bariatric surgery, but EWL rates can vary between patients depending on the type of surgical procedure used and decrease over time. The studies that compared LSG and LRYGB did not find any significant difference between the two surgical procedures.[23]

Bobowicz et al. reported the EWL rate as 43.6% in a 1-year follow-up study conducted with 112 patients who underwent LSG.[21] Similarly, D'Hondt et al. determined that the mean EWL rate of 83 patients was 72.3±29.3% 49 months after the surgery and decreased to 55.9%±25.55% 6 years after the surgery.[24] In another study, Lemanu et al. reported the 5-year EWL rate as 40%; whereas Felsenreich et al. reported that the EWl rate, which was 71±25% 1 year after the surgery, decreased to 53±25% 6 years after the surgery, and that conversion had to be performed to 36% of patients due to reasons such as weight gain and reflux.[7,25]

In comparison, the EWL rate was determined as 88.5% at the end of a 4-year follow-up period, higher than the respective results reported in the literature. On the other hand, weight regain rate was found as 30.2%, in line with the literature data. It can be speculated that the weight regain rate would increase, and the EWL rate would decrease over more extended follow-up periods. The analysis of the IQR values of EWL rates of patients revealed that both the mean age and pre-operative BMI values of those with lower EWL rates were high. In parallel, it has been reported in the literature that less weight loss is expected in patients with advanced age and BMI values >50.[26,27]

One of the criteria used to assess bariatric surgery success is patient satisfaction. In the study conducted by Nadalini et al. with 110 patients who underwent sleeve gastrectomy (SG), RYGB, and gastric banding, the comparative analysis of the pre-operative and post-operative SF-36 scores revealed significant improvements in all SF-36 subscales except for the general health perceptions and emotional well-being subscales and indicated that the physical functioning subscale scores were the best indicator of weight loss.[28] Fløl o et al. demonstrated that the scores obtained from both physical and mental health clusters of SF-36 significantly improved in patients who underwent SG 5 years after the surgery compared to before the surgery.[29] In contrast, in a study in which SF-36 was administered to 77 patients who underwent LSG 1, 3, and 5 years after LSG, the SF-36 scores were found to have deteriorated in all subscales over time due to weight regain.[13]

In a study conducted by D'Hondt et al. with 83 patients over a 6-year follow-up period, the comparison of the SF-36 scores between the patients with an EWL rate of >50% and patients with an EWL rate of <50% indicated that physical functioning and general health perceptions subscale scores were higher in the group of patients with an EWL rate of >50%.[24] Another study evaluated the QoL in different patient groups according to the rates of post-operative reflux and EWL and reported that the group with an EWL rate of >50% had higher scores in all subscales of SF-36, with significantly higher scores in the bodily pain, role limitations due to emotional problems, and emo-

tional well-being subscales, compared to patients with an EWL rate of <50%.[30]

The last two studies mentioned above demonstrated that comparing different patient groups after the surgery can be considered as important as comparing pre-operative and post-operative data, especially when it comes to QoL. As a reason, QoL is often found to be improved when comparing pre-operative and post-operative data; however, observing the effects on different patient groups within a cohort can reveal causative factors.

This study was designed as a post-operative SF-36 study, in parallel with the two studies mentioned above. In terms of weight loss and weight loss rates, EWL values were significantly correlated in the positive direction only with the role limitations due to physical health problems and general health perceptions subscales of SF-36. On the other hand, in terms of IQR values of the EWL rates of the patients, the median role limitations due to physical health problems subscale score in Group 1 (patients with an EWL ratio of ≤70.9) were found to be significantly lower than Group 2 (patients with an EWL rate >70.9) and Group 3 (patients with an EWL rate >88.5).

Gastroesophageal reflux disease (GERD), one of the factors affecting QoL, is an important complication observed after LSG. GERD, the incidence of which has been reported to be between 0.5% and 31% after bariatric surgery, is one of the primary reasons necessitating revision surgery after SG.[31] A systematic review and meta-analysis including 35 studies reported that reflux symptoms increased by 19% after LSG in patients with previous GERD, and 23% of the patients were diagnosed with GERD for the 1st time following LSG.[32] Patients with reflux scored lower in all subscales of SF-36, which suggests that reflux affects patients mentally as much as physically.[30]

Similarly, reflux was detected in 25.6% of the patients included in this study. Patients with reflux scored significantly lower in role limitations due to physical health problems, general health perceptions, and perceived change in health subscales of SF-36 compared to those without reflux.

The fact that pre-operative QoL parameters were not evaluated in this study may be seen as a limitation of the study. Nonetheless, the evaluation of only weight loss rates and reflux in patients who underwent LSG will also likely help determine the factors affecting their QoL.

Conclusion

LSG reportedly results in excellent outcomes in terms of weight loss and recovery from comorbidities in the early post-operative period. However, it is also important to evaluate the patients in terms of QoL parameters, given that insufficient weight loss, weight regain in the long term, gastrointestinal symptoms such as reflux, and relapse of obesity-related diseases may lead to dissatisfaction of patients. The findings of this study indicated that low EWL and symptomatic reflux after LSG adversely affect QoL. Further large-scale studies with more extended follow-up periods are needed to corroborate the findings of this study.

Disclosures

Ethichs Committee Approval: The study protocol was approved by the Haydarpaşa Numune Training and Research Hospital Ethics Committee (Approval No: HNEAH-KAEK 2021/261).

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