

Beyond weight loss after sleeve gastrectomy: improvement in health-related quality of life

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ABSTRACT

Objectives: Obesity and related diseases are increasing and with the bariatric procedures both the excess weight and the prevalence of these related diseases are decreasing. Both obesity and related diseases lead to impairment on health-related quality of life of the patients. We aimed to evaluate the short-term effects of sleeve gastrectomy operation on health related quality of life in patients that were operated for morbid obesity.

Methods: Prospectively 62 patients that had sleeve gastrectomy operation enrolled in the study. The percentage of excess weight loss (%EWL) and the percentage of excess BMI loss (%EBMIL) were calculated 6 months after the operation. Anthropometric data and obesity-related co-morbidities were recorded. SF-36 questionnaire was used in order to evaluate the general health quality of the patients.

Results: The mean age of the patients was 37 years and the majority of the patients were female (74.2%). At the postoperative 6th month, mean %EWL was calculated as 52.7% and mean %EBMIL was 60.1%. Six months after the operation, with the significant weight loss achieved, obesity-related co-morbidities were improved. Short Form-36 subscale scores at 6 months following the operation were observed, when compared with the preoperative scores (all $p < 0.001$). The mean physical health score significantly improved from 46.1 to 83.6 and the median mental health improved from 52 to 84, just 6 months after the sleeve gastrectomy operation. In multiple regression analysis %EWL was found to be a significant determinant of Δ Mental health (B coefficient 0.490, $p = 0.025$) and Δ Physical health (B coefficient 0.388, $p = 0.047$) after adjusting for gender, age, smoking, obstructive sleep apnea syndrome, hypertension, diabetes mellitus and coronary disease.

Conclusions: With the successive weight loss after sleeve gastrectomy, at the postoperative 6th month, the physical and mental health-related quality of life was significantly improved. Early and expedited regain of this quality of life after the operation is important for the patients and their social surroundings. Moreover it is important for the countries to decrease the medical expenses and increase labour productivity.

Keywords: Sleeve gastrectomy, quality of life, SF-36

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Obesity and the co-morbidities related to obesity are increasing. In the United States, 69% of the general population who are 20 years of age or older are overweight or obese according to the Centers for Disease Control and Prevention [1]. The prevalence of obesity has significantly increased among adult

Turkish population to 36% in 2010 (44% among women and 27% among men) [2]. While the number of obese people is continuously increasing, this increase is accompanied by an increase in obesity-related diseases, including type 2 diabetes, hypertension, cardiovascular diseases,



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musculoskeletal diseases, lipid disorders, etc. World Health Organization report on 2016 that, in Turkey, the latest prevalence of iabetes mellitus (DM), hypertension (HT) and lipid disorder increased to 14%, 20% and 40% respectively [3].

Obesity and related co-morbid conditions make negative impact on overall quality of life of the patients. In many studies it was shown that morbid obese patients had lower health-related quality of life (QOL) levels when compared to the normal population. Both Physical and Mental QOL scores were found to be low on studies. These findings are important as the prevalence of obesity is rapidly increasing and because of the Obesity and related co-morbid conditions, the economical burden of the countries is increasing regarding the social services and medical expenses [4-6].

There are different tools for calculating the general quality of life. One of the most simple and easily accessible scales is the Short Form-36 (SF-36). SF-36 questionnaire has been a reliable test to evaluate the general health quality of the patients. The questionnaire consists of 36 questions and 8 scales that assess the impact of the disease, on the health status. SF-36 was translated into Turkish and validation studies of Turkish version of SF-36 were performed in different patient groups for Turkish population [7-9].

Previously, mid and long-term studies were performed for QOL after bariatric surgery. With the weight loss achieved, the results had shown that, there is a significant improvement on both physical and mental health domains of QOL [10,11]. Keeping in mind that the maximum weight loss trend is on the first 6 months (mid-term), with this present study we aimed to evaluate the mid-term (6 month) health related QOL improvement of sleeve gastrectomy, which was performed in the morbidly obese patients.

METHODS

The study was conducted between January 2014-January 2015, and data were collected prospectively between the study dates. The institutional ethical committee of the Bursa Yüksek İhtisas Training and Research Hospital approved the study protocol. Patient consent forms were prepared and obtained

from all the patients that accepted to participate in the study. Patients with morbid obesity were consecutively enrolled in the study. Qualifying criteria's for bariatric surgery were;

- BMI > 40 kg/m² or
- BMI > 35 kg/m², when diagnosed with obesity related diseases, including type 2 DM, HT, lipid disorders, and obstructive sleep apnea syndrome (OSAS) and
- Age 18-65 years.

Patients who declined to participate in the study or who were lost during the follow-up were excluded. The following variables were obtained either from the patients' electronic medical records and patient paper charts: age, gender, co-morbid diseases (HT, Type 2 DM, OSAS, history of coronary arterial disease, musculoskeletal complaints etc.), smoke abuse, preoperative weight and height. Additionally, 6th month postoperative weight and height data were obtained from the patient follow-up forms.

The percentage of excess weight loss (%EWL) and the percentage of excess BMI loss (%EBMIL) were calculated as follows:

$$\%EWL = [(Operative\ weight - Follow\ up\ weight) / Operative\ excess\ weight] \times 100\%$$

The ideal weight was determined using Metropolitan Life Foundation Height - Weight Charts [12].

$$\%EBMIL = (pre\text{-}operative\ BMI - current\ BMI) / (pre\text{-}operative\ BMI - ideal\ BMI) \times 100\%$$

For this formula a BMI of 25 kg/m² (upper limit of normal BMI) was taken as the ideal BMI.

SF-36 questionnaire was used in order to evaluate the general health quality of the patients. The questionnaire consists of 36 questions and 8 scales that assess the impact of disease on the health status. The eight scales of the questionnaire include: general health, physical functioning, bodily pain, role limitations due to physical problems, emotional wellbeing, social functioning, vitality, and role limitations due to emotional problems. The first four domains summarize the overall individual physical function. The remaining four domains summarize the overall individual mental function. Each scale is scored between 0-100 according to the results. Higher scores are associated with better and lower scores are associated with worse quality of life level [13].

Table 1. Preoperative and postoperative changes in weight, BMI, % excess BMI and % excess weight loss (n = 62)

	Preoperative	Postoperative 6 th month	p value [†]
Weight	131 ± 18.7	93 ± 12	< 0.001
BMI	48 ± 5.2	34 ± 3.5	< 0.001
%EBMI loss		60.1 ± 12.8	
% EWL (excessive weight loss)		52.7 ± 12.7	
Age (years)		37 ± 9.1	
Gender (Female %)		46 (74.2%)	
Smoking		9 (14.5%)	
History of coronary arterial disease		2 (3.2%)	

Data are shown as mean ± standard deviation or number (%). BMI = body mass index, EBMI = excess body mass index, EWL = excess weight loss, [†] Paired-samples t test

Statistical Analysis

The data were analyzed for normal distribution of continuous variables using histograms and the Shapiro-Wilk test. The normally distributed continuous variables were reported as mean ± standard deviation (SD), while the non-normally distributed data were reported as medians (range). Categorical variables were reported as frequencies and percentages. To examine the differences between pre-operative and 6-month post-operative results, the continuous covariates were analyzed based on paired samples t test and Wilcoxon signed-rank tests. Categorical variables were analyzed with Chi-square test.

In multivariate analysis, in order to evaluate the effects of the change in the quality of life scores, with the weight loss after surgery and the other possible related conditions, a multiple linear regression model was constructed. By subtracting the pre-operative baseline scores of Mental and physical health, from the post-operative scores, the change of the scores were calculated. These changes that was referred as the Delta (Δ) Mental health and Δ Physical health were further entered into the multiple linear regression analysis with the %EWL in that period and with the

other independent variables. Unless otherwise indicated, a 5% type-I error level was used to refer statistical significance. All statistical analysis was performed using SPSS for Mac version 20.0 (SPSS Inc., Chicago, IL, USA).

RESULTS

During the study period sleeve gastrectomy operation was performed in 71 patients with the diagnosis of morbid obesity. While 4 patients were lost in the follow-up, 5 patients declined to participate to the study. Totally 62 patients were included in the data analysis. The mean age of the patients was 37 and the vast majority of the patients were female (74.2%). On the postoperative 6th month, the mean weight had decreased from 131 kg to 93 kg, and the mean BMI decreased from 48 to 34 kg/m². Mean % EWL was calculated as 52.7 % and mean %EBMI loss was 60.1 % (Table 1).

Preoperative data showed that the major comorbidities were HT in 22.6%, Type 2 DM in 16.1% and OSAS in 8.1% of the patients. More than half of the patients (59.7%) had major musculoskeletal

Table 2. Univariate comparison of the comorbidities in the 6th month weight loss after sleeve gastrectomy

	Preoperative	Postoperative 6 th month	p value [†]
Hypertension	14 (22.6)	5 (8.1)	< 0.001
Type 2 Diabetes Mellitus	10 (16.1)	4 (6.5)	< 0.001
OSAS	5 (8.1)	1 (1.6)	0.08
Musculoskeletal complaints	37 (59.7)	14 (22.6)	< 0.001

Data are shown as number (%). OSAS = obstructive sleep apnea syndrome, [†] Chi-square test

complaints (MSC) preoperatively. Six months after the operation, with the significant weight loss achieved, the results revealed that these comorbid conditions were improved statistically (HT, DM, MSC; $p < 0.001$ but except OSAS; $p = 0.08$) (Table 2).

A significant improvement in all of the SF-36 subscale scores at 6 months following the operation was observed, when compared with the preoperative scores (all $p < 0.001$). The mean physical health score significantly improved from 46.1 to 83.6. On the other

hand median mental health improved from 52 to 84, just 6 months after the sleeve gastrectomy operation. SF-36 questionnaire results and the subgroup comparisons are detailed in Table 3.

In multiple regression analysis %EWL was found to be a significant determinant of Δ Mental health (B coefficient 0.490, $p = 0.025$) and Δ Physical health (B coefficient 0.388, $p = 0.047$) after adjusting for gender, age, smoking, OSAS, HT, DM and coronary disease (Table 4 and 5).

Table 3. Univariate comparison of SF-36 questionnaire scales preoperatively and 6th month postoperatively

	Baseline preoperative	Postoperative 6 th month	<i>p</i> value ^a
Physical Functioning	43 [20-60]	80 [75-95]	< 0.001
Role limitations due to a physical problem	25 [19-50]	100 [75-100]	< 0.001
Pain	69 [39-84]	90 [80-100]	< 0.001
General Health*	45.9± 16.8	78.7 ± 10.6	< 0.001 ^b
Role limitations due to an emotional problem	33 [33-67]	100 [67-100]	< 0.001
Energy/Fatigue/Vitality	55 [40-61]	80 [70-90]	< 0.001
Social Functioning	63 [25-75]	100 [75-100]	< 0.001
Emotional wellbeing	64 [52-72]	74 [68-85]	< 0.001
Physical health*	46.1 ± 17.5	83.6 ± 8.3	< 0.001 ^b
Mental health	52 [46-62]	84 [76-89]	< 0.001

Data are shown as median [IQR25- IQR75] or mean ± standard deviation, ^a Wilcoxon signed-rank test, ^b Paired-samples t test

Table 4. Multiple linear regression for the change in SF-36 General Mental health domain

Dependent Variable	Independent Variables	B coefficient	Std. Error	Std (B)	t	P value	95% Confidence Interval	
							Lower bound	Upper bound
Δ Mental health	Smoking	0.865	3.767	0.032	0.230	0.816	-6.695	8.424
	OSAS	16.666	11.123	0.229	1.498	0.140	-5.653	38.985
	HT	4.062	6.778	0.086	0.599	0.552	-9.538	17.663
	DM	0.892	8.527	0.017	0.105	0.917	-16.219	18.002
	Coronary disease	2.341	23.638	0.015	0.099	0.921	-45.092	49.775
	%EWL	0.490	0.213	0.313	2.300	0.025	0.063	0.917
	Age	-0.208	0.325	-0.094	-0.639	0.526	-0.859	0.444
	Musculoskeletal complaints	0.833	5.726	0.021	0.146	0.885	-10.657	12.323
Gender	-10.114	7.249	-0.224	-1.395	0.169	-24.659	4.431	

DM = diabetes mellitus, EWL = excess weight loss, HT = hypertension, OSAS = obstructive sleep apnea syndrome

Table 5. Multiple linear regression for the change in SF-36 General Physical health domain

Dependent Variable	Independents	B	Std. Error	Std (B)	t	p value	95% Confidence Interval	
							Lower bound	Upper bound
Δ Physical health	Smoking	-1.755	3.366	-0.074	-0.521	0.604	-8.509	4.999
	OSAS	10.346	9.938	0.162	1.041	0.303	-9.596	30.289
	HT	0.778	6.056	0.019	0.129	0.898	-11.374	12.931
	DM	2.070	7.619	0.044	0.272	0.787	-13.218	17.359
	Coronary disease	1.183	21.121	0.009	0.056	0.956	-41.200	43.566
	%EWL	0.388	0.190	0.282	2.037	0.047	0.006	0.770
	Age	0.109	0.290	0.057	0.376	0.708	-0.473	0.691
	Musculoskeletal complaints	0.744	5.116	0.021	0.145	0.885	-9.522	11.011
Gender	0.910	6.477	0.023	0.140	0.889	-12.087	13.906	

DM = diabetes mellitus, EWL = excess weight loss, HT = hypertension, OSAS = obstructive sleep apnea syndrome

DISCUSSION

Sleeve gastrectomy is rapidly increasing, as it is a promising procedure with early and late prosperous results of the %EWL, with minimal anatomical change and with its acceptable complication rates [14].

In current literature, with various surgical operations or with non-surgical endoscopic approaches, the %EWL at 6-months post-procedure was found to be 33.6% - 52.6%. In a study by Nocca *et al.* [15], %EWL was found to be 48.9% in the 6th postoperative month follow-up, specifically after sleeve gastrectomy. In accordance with previous reports, in our study group we found %EWL and %EBMIL to be 52.7% and 60.1%, respectively, 6 months after sleeve gastrectomy (Table 1). In a recent study, Nikolic *et al.* [16] found that 6 months after sleeve gastrectomy, 60% of the patients achieved success in weight loss (success is $EWL \geq 50\%$). In our study population, 61.3 % of the patients achieved successful weight loss by the 6th month of sleeve gastrectomy.

There are many comorbid conditions that were found to be related with obesity, mainly cardiovascular diseases, Type 2 Diabetes Mellitus, pulmonary diseases like OSAS, asthma and musculoskeletal problems [17]. After weight loss operations it was shown that, these critical conditions and diseases are

improved and even totally cured [18, 19]. The main pathophysiology of this improvement still is not clear and it is not yet understood that if only the weight loss is responsible in this improvement or if there are any other possible reasons like complicated molecular mechanisms [20]. In the early period of bariatric procedures, it was shown that in a significant number of the patients these comorbid conditions were improved. Bobowicz *et al.* [19] reported that the improvement of HT, DM, OSAS and Osteoarthritis, 1 year after sleeve gastrectomy was 28.6%, 27.8%, 100% and 11.1% respectively [19]. In our study improvement for HT was 64%, for DM it was 60%, for OSAS it was 80% and for musculoskeletal complaints it was 62% in the 6th month of sleeve gastrectomy surgery. In the same study the 6th month EWL% was found to be 36.8%, which was far more less than our results (52.7%). We believe that this could be the possible reason of the superior comorbidity improvement that was found in our study population. When preoperative and postoperative comorbidity improvement was assessed, it was found that all documented comorbid conditions improved statistically ($p < 0.001$ for all, except for OSAS in which $p = 0.08$). This shows that in the early period of the procedure, the surgery success with better weight loss is important for the improvement of these comorbidities. As one can expect, this is

associated with the improvement on the health related quality of life in this patient population. Furthermore it was also previously shown that smoking has a negative impact on Health quality of life [21]. In this present study population we found that 14.5% of the patients are current smokers.

The previous studies focused on the improved scores of different QOL questionnaire's with different types of Bariatric surgical procedures. Major *et al.* [11] compared 2 bariatric procedure, Roux-en Y gastric bypass and SG regarding the obesity related disease and quality of life improvement and found no difference between these two procedures. But they found that the quality of life was enhanced significantly for both procedures [11]. Similar results were found after the Gastric band operations and sleeve gastrectomy when performed as primary procedures [6, 22]. Charalampakis *et al.* [22] showed that the steep increase in the QOL of the patients with SG has peaked at 12th months.

Our study showed an improvement on the scores for physical functioning and limitations due to physical problem, pain and general health. Generally physical health is found to be improved 6 months after surgery. The weight loss, leads to ease in the motions of the patients, moreover the pain decreases and this decline might be the reason for this movement capacity that even gets better. The improvement on the physical health is also improving the general health scores. Patients are much more active in daily life and this increase in movement lead to additive effect on weight loss as well.

The mental health domains are also improving after the operation. Although all changes in the mental health scores (vitality, social functioning, emotional wellbeing and limitations due to emotional problem) in the postoperative period were statistically significant (Table 3), the weakest improvement in the scores of SF-36 seems to be in the Emotional wellbeing scores. There are studies that even found that mental health scores are not improving after the surgery [23]. Nevertheless most of the studies show the statistical improvement in mental health domain as well. Social functioning is also improving in SF-36 domains and this finding supports that with the weight loss achieved early after SG operation patients express that they are feeling more confident in social associations and they feel less discriminations from others in the population

[10].

Limitations

There are couples of limitations of our study. First of all the number of the patients that enrolled in our study is low and the lack of long-term follow-up is another downside. Secondly there is no control group with the other treatments for weight loss like medications, diet etc. Nevertheless this study is one of the first studies that show early benefit of surgical weight loss on QOL for the patients that are Morbidly obese.

CONCLUSION

With the successive weight loss after sleeve gastrectomy operation, just 6 months after the operation, the physical and mental health related quality of life has improved. Results showing the pretentious improvement on quality of life after bariatric surgery might also explain the increased number of operations, despite the difficulty and potential complications of surgery. Early and expedited regain of this QOL after the operation, which was deteriorated during the obesity years, may lead to reduction in the economical burden of countries both in the social services and medical expenses.

Conflict of interest

The authors disclosed no conflict of interest during the preparation or publication of this manuscript.

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