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Influence of complications and extent of weight loss on quality of life after laparoscopic Roux-en-Y gastric bypass

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Abstract
Introduction: Obesity decreases health-related quality of life, but bariatric surgery improves it. This study evaluates the effect of laparoscopic Roux-en-Y gastric bypass, postoperative complications, and percentage of excess body weight loss on quality of life.
Methods: SF-36v.1 questionnaires were administered preoperative (n = 505), 1 year (n = 237) and 2 years (n = 106) following laparoscopic Roux-en-Y gastric bypass. Analysis was performed using Student's t-test and multiple logistic regression analysis. Complications were defined as requiring additional intervention or hospitalization. SF-36 responses were normalized to 1998 US norms.
Results: Bariatric patients scored significantly lower on all scales compared to the normal population. Health-related quality of life notably improves after surgery. At 1 year, scores not only improved from baseline, but were higher than those of the non-obese reference population regardless of complications. Compared to patients at 2 years without complications, patients experiencing complications reported decreased scores, but scores remained higher than preoperative scores in five scales. At 1 and 2 years, $\leq$50% excess body weight loss decreased scores; however, scores were significantly improved from baseline.
Conclusions: Health-related quality of life in bariatric patients is worse than in controls, but it improves 1 and 2 years after laparoscopic Roux-en-Y gastric bypass. Complications or $\leq$50% excess body weight loss slightly decreases this improvement.

Key words: Quality of life — Morbid obesity — Laparoscopic gastric bypass — Obesity surgery — Postoperative complications

Obesity is an increasing problem in both developed and developing nations [14]. Morbid obesity (body mass index [BMI] > 40 kg/m^2 or BMI > 35 kg/m^2 with co-morbidities) results in health, psychosocial, and socio-economic repercussions on an individual level, but it also adds a staggering economic burden to society as a whole. Obesity has been linked to almost 300,000 deaths yearly and $117 billion dollars in direct and indirect annual healthcare spending in the United States alone [1, 22]. The prevalence of obesity has been steadily increasing as the age-adjusted prevalence of obesity (BMI $\geq$ 30) in this country is now greater than 30% [9]. The primary goals of treatment are to control concomitant diseases, symptoms, and complaints, and to minimize psychosocial adverse effects by reducing weight. Bariatric surgery is the only treatment modality that results in maintained weight loss and control of medical co-morbidities related to obesity [10].

While many of the studies regarding bariatric surgery outcomes focus on percentage of excess body weight loss (%EWL) and resolution of co-morbidities, another essential measure of treatment efficacy is the effect surgery has on patients' everyday life and well-being, the health-related quality of life (HRQL). Health-related quality of life is gaining increased attention as its importance in evaluating the effectiveness of treatment modalities is realized [4, 12]. Moreover, HRQL is a particularly relevant construct in weight-loss research because obesity has been shown to exert significant negative consequences on HRQL, which improve with adequate weight loss [7, 11, 23, 18, 19].

Studies suggest HRQL is improved after open Roux-en-Y gastric bypass [3, 6], and more recent data suggest improvement in HRQL is achieved more rapidly

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and is maintained after laparoscopic Roux-en-Y gastric bypass (LRYGB) [15, 16]. Although these outcomes imply overall enhancement of HRQL after LRYGB, we are unaware of outcomes studies regarding the patients who suffer postoperative complications or experience ≤ 50% EWL. This study aims to address HRQL in these patient groups.

Materials and methods

Patients (505: preoperative; 237: 1-year follow-up; 106: 2-year follow-up) who underwent LRYGB by one surgeon (R.H.C.) for morbid obesity between August 2001 and August 2005 were included in this study to assess HRQL measured by the SF-36 Health Survey version 1 [13]. Eight scales are included in this questionnaire: physical function, role—physical, bodily pain, general health, vitality, social function, role—emotional, and mental health. Patients were selected for operation using accepted National Institutes of Health (NIH) criteria.

The SF-36 was administered in person during the preoperative and postoperative clinical visits. During the preoperative clinic visit, participants were instructed that this questionnaire would be administered during this visit and at each annual postoperative visit. The participant was given a paper copy of the SF-36 to complete, and return during the same visit to the research nurse administrator (T.D.L.), who was present and able to respond to questions about the questionnaire if necessary. The participant responses were abstracted from the paper copy into a Microsoft Access database. Transformed scores and norm-based scores were obtained using the QualityMetric SF Health Outcomes Scoring Software (QualityMetric Incorporated, Lincoln, RI). The software standardized the scores using the means and standard deviations obtained from the 1998 U.S. general population. Norm-based scores range from 0 to 100, with a mean of 50 and a standard deviation of 10.

Preoperatively, demographic and obesity-related health information was collected. In the postoperative follow-up period, weight, BMI, %EWL, and complications requiring intervention were recorded at each visit. The two-tailed Student's *t*-test was used to compare the mean values of the eight SF-36 scales preoperatively, at 1 year postoperatively, and at 2 years postoperatively. Complications and EWL variables for the two postoperative follow-up surveys were also measured. Multiple linear regression analysis (MLRA) of the full model included demographics, BMI, preoperative co-morbidities, prior abdominal procedures, operative and follow-up variables for the two postoperative surveys to test the impact of complications and EWL on HRQL at each of the eight SF-36 scales at 1 year and at 2 years after LRYGB.

Results

Each patient underwent LRYGB without conversion to an open procedure. The mean operative time was 101.7 min (range, 62–227 min). A total of 505 patients completed preoperative SF-36 questionnaires. Of 423 eligible patients, 237 (56%) completed SF-36 questionnaires at 1 year following surgery, and 106 of 332 (32%) eligible patients completed a questionnaire at 2 years. Demographic data for these groups are reported in Table 1.

Health-related quality of life results for patients preoperatively and at 1 and 2 years after LRYGB are reported in Table 2. Compared to a US normalized mean score of 50 in each scale, preoperative patients scored significantly lower on all scales of the SF-36 HRQL survey. At 1 year after LRYGB, values in each of the eight scales were significantly increased from preoperative scores and normalized controls (Table 2 and 3). Improvement from baseline remained statistically significant in all eight scales of the SF-36 at 2 years, however to a lesser extent than at 1 year. Overall scores for the 2-year population compared to patients at 1 year reported significantly lower scores in each scale except physical function (52.7 [± 7.7] versus 53.3 [± 7.5], respectively, $p = 0.51$; Table 2). When compared to the US normal population at 2 years after surgery, patients scale scores were significantly higher in the physical function, general health, and vitality scales (Table 3).

Table 1. Patient variables before and at 1 and 2 years after laparoscopic Roux-en-Y gastric bypass

	Preoperative	1 year	2 year
Number	505	237	106
Mean age in years ± SD	40.6 ± 9.0	40.9 ± 9.0	41.4 ± 9.1
Female (%)	432 (85.5)	206 (86.9)	95 (89.6)
Race (%)			
White	415 (82.2)	201 (84.8)	91 (85.9)
African American	87 (17.2)	34 (14.4)	14 (13.2)
Unknown	3 (0.6)	2 (0.8)	1 (0.9)
Body mass index			
Mean ± SD	48.3 ± 6.9	30.2 ± 5.4	28.3 ± 5.1
Range	34–72	19.5–53.9	19.6–44.2
Percent EWL			
Mean ± SD		72.4 ± 15.1	78.5 ± 16.5
Range		28.8–120.6	38.6–116.7

The overall rate of postoperative complications requiring intervention in our study group was 17.3% at 1 year and 21.7% at 2 years of follow-up (Table 4). There was one in-hospital death. Patients experiencing complications within the first year following LRYGB reported significant improvement in all 8 scales of the SF-36 over preoperative levels, and mean values were greater than normalized controls (Fig. 1). At 1 year patients with complications scored significantly lower than those without complications in only one of eight scales, vitality (58.1 [± 9.1] versus 54.2 [± 10.2], respectively, $p = 0.029$; Table 5). However, there was no difference in the MLRA model.

Data at the 2-year follow-up are reported in Figure 2. Patients experiencing complications had statistically significant improvement over preoperative levels in all but three scales: social function, role—emotional, and mental health. Compared to patients at 2 years without complications, patients experiencing complications reported decreased HRQL scores in six of eight scales: role—physical, bodily pain, general health, vitality, social function, and mental health (Table 5). In MLRA, all scales in patients with complications were significantly decreased except for physical function and general health.

Patients who lost ≤ 50% EWL reported improvement in all 8 scales of the SF-36 over preoperative levels, and mean scores were not statistically different from the scores of those who lost > 50% EWL at 1 year ($n = 10$) or at 2 years ($n = 6$) after surgery ($p > 0.05$ for each scale). Furthermore, on MLRA, patients who lost ≤ 50% EWL did not demonstrate any significantly lower scale score than those who lost more weight at 1 year, except for physical function; at 2 years, none were lower.

Table 2. Preoperative and postoperative SF-36 scores for all patients presented as mean ± standard deviation. US normalized mean score in all 8 scales is 50

Scales	Preoperative	1 year	2 year	p*	p**
N	505	237	106		
Physical function	31.46 ± 9.66	53.29 ± 7.49	52.71 ± 7.73	<0.0001	0.5115
Role—physical	36.85 ± 10.11	54.07 ± 6.73	51.79 ± 9.27	<0.0001	0.0248
Bodily pain	38.46 ± 9.77	54.69 ± 10.23	51.78 ± 11.56	<0.0001	0.0270
General health	35.32 ± 9.73	56.85 ± 6.90	54.63 ± 8.69	<0.0001	0.0230
Vitality	35.21 ± 9.49	57.38 ± 9.41	52.15 ± 10.81	<0.0001	<0.0001
Social function	36.50 ± 11.91	53.25 ± 8.11	49.35 ± 12.33	<0.0001	0.0034
Role—emotional	41.92 ± 13.55	52.91 ± 7.29	49.42 ± 10.73	<0.0001	0.0029
Mental health	43.35 ± 11.56	54.25 ± 9.76	50.15 ± 10.20	<0.0001	0.0006

* Student's t-test analysis of 1 year versus preoperative scales and 2 year versus preoperative scales (p values for all comparisons <0.0001)
** Student's t-test analysis of 1 year versus 2 year postoperative scores

Table 3. SF-36 mean normalized scale scores for preoperative, 1 year and 2 years after laparoscopic Roux-en-Y gastric bypass compared to 1998 U.S. normal population mean scores

	1998 US norms		Preoperative		1 year		2 year	
SF-36 scales	Mean ± SD	p Value*	Mean ± SD	p Value*	Mean ± SD	p Value*	Mean ± SD	p Value*
Physical function	50 ± 10	ref	31.46 ± 9.66	<0.0001	53.29 ± 7.49	<0.0001	52.71 ± 7.73	0.0059
Role of physical	50 ± 10	ref	36.85 ± 10.11	<0.0001	54.07 ± 6.73	<0.0001	51.79 ± 9.27	0.0704
Bodily pain	50 ± 10	ref	38.46 ± 9.77	<0.0001	54.69 ± 10.23	<0.0001	51.78 ± 11.56	0.0748
General health	50 ± 10	ref	35.32 ± 9.73	<0.0001	56.85 ± 6.90	<0.0001	54.63 ± 8.69	<0.0001
Vitality	50 ± 10	ref	35.21 ± 9.49	<0.0001	57.38 ± 9.41	<0.0001	52.15 ± 10.81	0.0308
Social Function	50 ± 10	ref	36.50 ± 11.91	<0.0001	53.25 ± 8.11	<0.0001	49.35 ± 12.33	0.5167
Role of emotional	50 ± 10	ref	41.92 ± 13.55	<0.0001	52.91 ± 7.29	<0.0001	49.42 ± 10.73	0.5600
Mental health	50 ± 10	ref	43.35 ± 11.56	<0.0001	54.25 ± 9.76	<0.0001	50.15 ± 10.27	0.8799

* The p values were calculated using a Student's t-test comparing each group to US norms

Table 4. Complications requiring intervention after laparoscopic Roux-en-Y gastric bypass; all values reported as n (%)

	1 year n = 237	2 year n = 106
All	41 (17.3)	23 (21.7)
Ulcer	23 (9.7)	17 (16.0)
Stricture	22 (9.3)	11 (10.4)
Internal hernia	14 (5.9)	6 (5.7)
Gastric outlet obstruction	3 (1.3)	1 (0.9)
Leak	2 (0.8)	0 (0)
Gastrointestinal bleed	2 (0.8)	1 (0.9)
Cholecystitis	1 (0.4)	0 (0)
Superior mesenteric vein thrombosis	1 (0.4)	0 (0)
Malrotation	0 (0)	1 (0.9)

Discussion

Patients undergoing LRYGB may expect a significant increase in HRQL, which can be sustained at 2 years, even in the settings of surgery-related complications or ≤ 50% EWL.

At 1 year following LRYGB, HRQL measurements were not only improved from preoperative levels but also were also quantitatively better than the non-obese reference population, even those with surgical complications. Exceeding the reference values for the HRQL measures is consistent with the "euphoria effect" commonly observed after RYGB-induced weight loss [12]. Choban et al. [3] reported that, at 1 year after obesity surgery, some scale scores exceed those of US norms. An initial increase above US norms after surgery with a subsequent decrease in scores over time was also found by Dixon et al. [5]. We confirm their findings and have also demonstrated a pattern of HRQL that is increased from controls at 1 year while mean scores were slightly lower at 2 years after LRYGB. This phenomena may also have a role in the decision bias that patients may demonstrate in defending their choice to undergo surgery. In addition, patients may report a higher level of quality of life while filling out their questionnaire than they are actually experiencing as a form of reassurance to themselves that they made the right decision.

Patients who developed complications within 2 years after LRYGB reported lower scores in the role—physical section, which categorizes perceived level of accomplishment, limitations in types of activities performed, and level of difficulty of work or other activities. They did not report any difference in the physical function scale, however, which addresses specific tasks such as getting dressed, walking, and climbing stairs. Postoperative complications may lead to a general perception of lower functioning, whereas in actuality these patients perform specific activities of daily living at the same level as patients without complications.

Patients with complications at 2 years also reported a lower mental health score, which is based on questions relating to mood. When asked about the effect their emotions had on activities of daily living, work, and relationships in the role—emotional subscale, however, these patients reported no difference than those who had

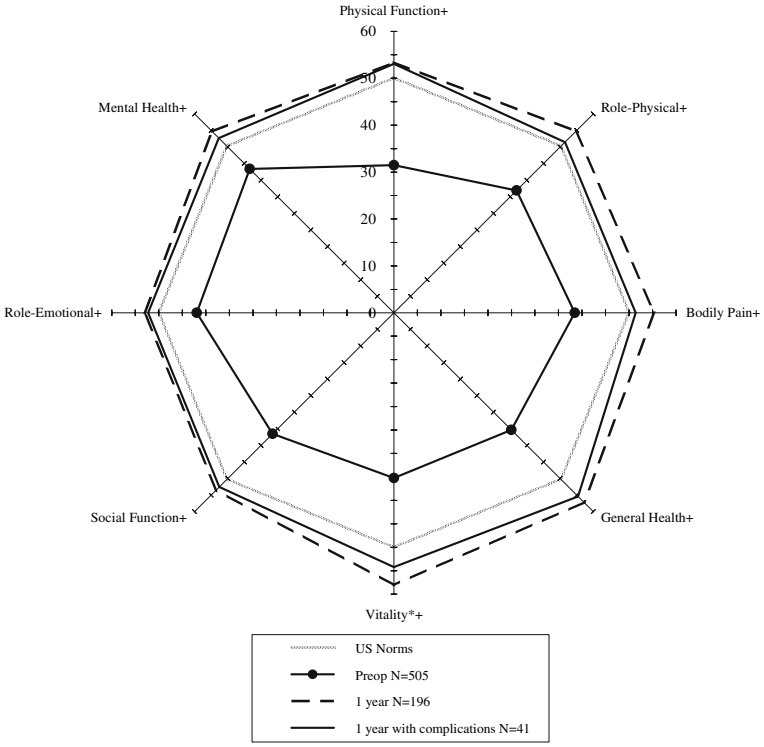

Fig. 1. SF-36 scale scores preoperatively and at 1 year following laparoscopic Roux-en-Y gastric bypass (* = $p < 0.05$ for 1 year score compared to 1 year score with complications, + = $p < 0.05$ for 1 year with complications compared to preoperative score).

Table 5. One- and 2-year SF-36 scale scores for patients with and without complications

	1 year			2 year		
Normalized scale scores ±SD	Without complication $n = 196$	With complication $n = 41$	p Value	Without complication $n = 83$	With complication $n = 23$	p Value
Physical function	53.35 ± 7.50	53.04 ±7.57	0.8167	53.37 ± 7.03	50.30 ± 9.66	0.1657
Role—physical	54.64 ± 5.53	51.41 ± 10.42	0.0605	53.14 ± 7.46	47.02 ± 13.05	0.0407
Bodily pain	55.39 ± 9.46	51.39 ± 12.96	0.0668	53.66 ± 10.47	44.99 ± 12.92	0.0059
General health	57.16 ± 6.90	55.35 ± 6.80	0.1279	55.88 ± 7.35	49.99 ± 11.57	0.0319
Vitality	58.06 ± 9.12	54.19 ± 10.18	0.0286	54.53 ± 8.69	43.56 ± 13.33	0.0009
Social function	53.41 ± 8.16	52.50 ± 7.92	0.5112	51.91 ± 9.53	40.14 ± 16.56	0.0031
Role—emotional	53.04 ± 7.01	52.26 ± 8.57	0.5843	50.59 ± 9.81	45.26 ± 12.89	0.0764
Mental health	54.60 ± 9.72	52.62 ± 9.89	0.2470	51.79 ± 8.40	44.25 ± 13.92	0.0199

not experienced complications. Because of the complications, this phenomenon may also be explained by an overall perception of mental and physical function as worse than they actually are. Although complications negatively affected bodily pain, general health, vitality, and social function scores compared to patients without complications, all eight scales were either no different or significantly improved compared to preoperative scores. Results of the present study offer valuable information for preoperative patient education to reassure the morbidly obese individual that HRQL after surgery will likely be improved compared to preoperative levels, even if postoperative complications occur.

The results of loss of body weight lie within the experience of most groups reporting on this type of surgery with median values for %EWL at 72.4 (± 15.1) 1 year after surgery and 78.5 (±16.5) at 2 years after surgery. Complication rates were also consistent with outcomes of other large studies [5, 15, 16, 20]. However, because complication rates were low, the number of patients experiencing an adverse event was low, with only 41 patients at 1 year and 23 at 2 years available for comparison. These low numbers limited power to analyze the extent each complication had on the HRQL score. Demographic data were also similar to those of other large published studies [5, 16, 20]; however, the present study may have limited applicability to populations other than Caucasian.

The definition of successful weight loss after bariatric surgery has been widely accepted as 50% or more EWL. This degree of weight loss consistently provides resolution of co-morbidities [2]. However, in our study, patients with ≤ 50% EWL at 1 year did not suffer any significant detrimental effect on HRQL compared to those losing >50%, except in the physical function scale, and at 2 years there was no difference in any scale. This demonstrates that our definition of success after bariatric surgery may not be the same as the patient's

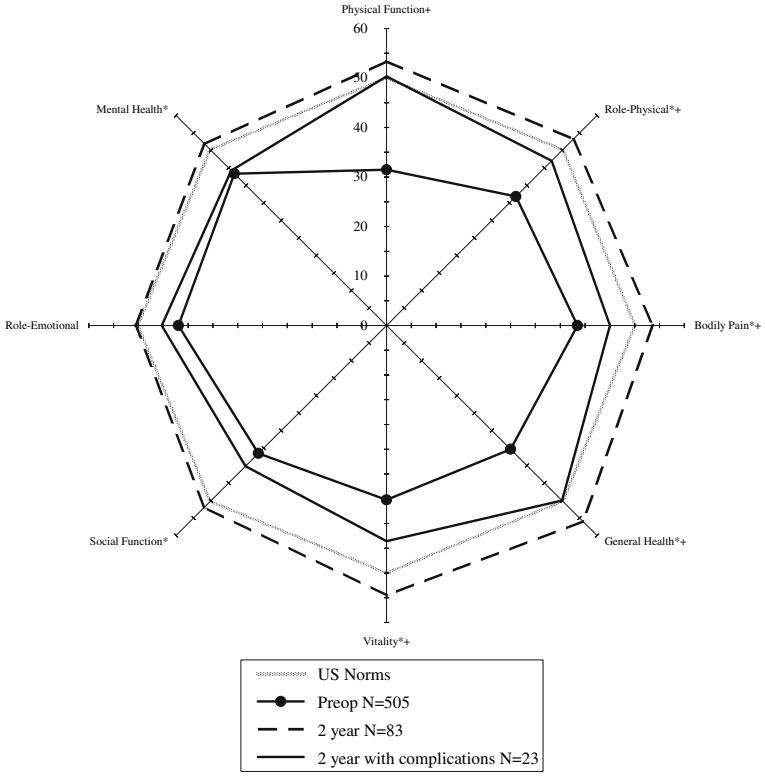

Fig. 2. SF-36 scale scores preoperative and at 2 years following laparoscopic Roux-en-Y gastric bypass (* = $p < 0.05$ for 2 year score compared to 2 year with complications, + = $p < 0.05$ 2 year with complications compared to preoperative score).

definition. These outcomes have to be considered in the setting of low numbers of patients in the ≤ 50% EWL group. There were 10 patients at 1 year and only 6 patients at 2 years with ≤ 50% EWL that were eligible for comparison. A larger group of subjects with ≤ 50% EWL weight loss would help validate these findings.

Long-term follow-up for bariatric patients is essential, and we strongly urge each patient to return for annual assessments. We contact patients by e-mail, telephone, letter, and postcard to encourage return for follow-up. Despite these efforts, we were only able to achieve 56% follow-up at 1 year and 32% follow-up at 2 years for patients included in this study. This may be due in part to the wide geographical area from which we drew our population. In addition, it may be that patients feel well and do not think it necessary to return to the doctor's office, or perhaps the opposite is true, and patients feel embarrassed if they have not lost enough weight or if they are not complying with dietary and lifestyle recommendations. These factors, and possibly others, raise the specter of bias in our comparisons. These results can be helpful, however, in that they reflect a real-world bariatric practice where compliance with instructions cannot always be enforced.

Consideration of the HRQL outcomes after bariatric procedures has been accepted into clinical practice, and the data that support improvement after surgery are reassuring for both patients and physicians. As in the present review of LRYGB patients, several other reports have demonstrated improved HRQL despite complications following different bariatric procedures such as gastric banding [8, 22] and ileogastrostomy [17]. One study of 18 patients who underwent open Roux-en-Y gastric bypass also reported improved HRQL in patients with postoperative complications [22]. Such studies highlight the severe adverse effect obesity has on HRQL and show that even when bariatric surgery results in significant adverse events, the improvement in HRQL is significant enough to overshadow most complications of the operation. Our data reinforces the idea that despite the risks of complications, LRYGB results in improved quality of patients' lives in terms of their health.

Conclusions

Health-related quality of life in patients seeking bariatric surgery is significantly lower than the general population; however, after LRYGB, HRQL is dramatically improved and sustained at 2 years. Patients experiencing a complication or ≤ 50% EWL also report improved HRQL from baseline; however, to a lesser extent.

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