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ORIGINAL CONTRIBUTIONS

Predictors of Health-Related Quality of Life After Bariatric Surgery

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Abstract
Background Bariatric surgery is typically associated with improvement in health-related quality of life (HRQoL). However, recent reports are conflicting, and the aim of this study was to determine factors that would be predictive for long-term outcomes after bariatric procedures.
Methods One thousand five hundred and seventy-three patients at one Midwestern academic medical center who underwent any type of bariatric surgery were sent the SF-36 survey. Three hundred and fifty completed surveys collected over a 3-month period were returned. Multivariate analysis was conducted.
Results The physical and mental component scores were significantly lower than the norm population mean. Age at time of surgery, pre-surgical body mass index (BMI) and duration since surgery were negatively related to HRQoL.
Conclusions Improvements in HRQoL following bariatric surgery do not appear to be sustained over the long term. Older patients and those with high pre-surgical obesity do not appear to have the same benefits in HRQoL over time.

Keywords Bariatric surgery · Health-related quality of life (HRQoL) · Gastric bypass · Gastric banding · Sleeve gastrectomy · Biliary pancreatic diversion

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Introduction

In the USA today, obesity is one of the most common health-related concerns with a current prevalence of 35.1 % in adults [1]. It is associated with a series of medical risks and a lowered health-related quality of life (HRQoL) [2]. A majority of the studies involving weight loss are short term and reveal a positive correlation with HRQoL across age, ethnicity, and gender over a wide range of body mass indexes and weights [3].

Bariatric surgery has been demonstrated to be the most durable option for weight loss [3, 4] and has been typically reported to enhance HRQoL [5]. The impact on HRQoL is an increasingly vital metric that is being promoted to evaluate additional secondary outcomes [5], and similar to weight loss results, inconsistencies and disparities are becoming more apparent [6]. The pattern of improvement of HRQoL following bariatric surgery commonly reflects the phases of weight loss with the most improvement occurring in 1 to 3 years following surgery [7]. The Swedish Obesity Study (SOS), an observational study, has shown long-term maintenance of these HRQoL benefits for 10 years [8], while another study showed benefits for 6 years [6]. Overall, HRQoL studies that have extended over a longer period of time, or include several types of bariatric surgery, are sparse.

We completed this study to evaluate HRQoL in all post-surgical patients (going back nearly two decades) at one Mid-western academic medical center to examine factors that could contribute to HRQoL. The inclusion of all types of bariatric surgery is unique and was designed to fill in gaps in current knowledge regarding long-term outcomes. Our objective was to enhance understanding of influential predictors.

Methods

A Nebraska-based cross-sectional survey was conducted between January 2014 and April 2014. The survey was mailed to all patients from a prospectively collected bariatric surgical database. Patients included those who had undergone bariatric surgery or received follow-up care at an academic medical center (n=1573). A priori sample size analysis indicated that 309 completed surveys would yield results with a 95 % confidence level and 5 % margin of error. We collected 350 surveys during the 3-month period and excluded 30 surveys that were received after the cutoff period.

The SF-36, a commonly-used measure of HRQoL, assesses the self-reported opinion of the patients regarding their physical and mental functioning. The tool has been well-validated as a reliable and consistent instrument applicable across populations and disease states [9]. The SF-36 evaluates eight subscales of HRQoL: general health, physical functioning, role limitations due to physical health, energy/fatigue, pain, emotional well-being, role limitations due to emotional problems, and social functioning. Subscale scores were weighted and transformed into physical and mental component scores (PCS and MCS, respectively), reported as t-scores, with an average of 50 and a standard deviation of 10. The RAND version of the 36-Item Short Form Health Survey (SF-36) was used for this study [9]. In addition, questions pertaining to sex, ethnicity and race were included. A review of electronic medical records provided patient demographic information including age, weight, and body mass index (BMI) at the time of surgery, as well as the details regarding the type of surgery. This study was reviewed by the University of Nebraska Medical Center IRB (protocol # 666-13-EX).

Results

A total of 350 completed surveys were received (22 % response rate). Initial bariatric surgical procedures included gastric bypass (n=224), adjustable gastric banding (n=58), sleeve gastrectomy (n=36), and biliary pancreatic diversion (n=27, Table 1). Surgery type was not available for five respondents, who were thus excluded from multivariate analyses. Patients who had undergone revision surgeries were placed with their initial surgery cohort. This surgical approach was available for 286 patients in the database, 211 of which were laparoscopic, and 75 were open. Due to the missing data on 64 patients, the type of surgery was not included in a subanalysis.

Table 1 Description of sample

	Number	Percent
Sex		
Female	292	83.4
Male	58	16.6
Race		
White	316	90.3
Black or African American	20	5.7
Hawaiian or Pacific Islander	1	0.3
More than one race indicated	4	1.1
Other	3	0.9
Race unknown	6	1.7
Ethnicity		
Hispanic or Latino	17	4.9
Not Hispanic or Latino	331	94.6
Ethnicity unknown	2	0.6
Surgery type		
Gastric bypass	224	64.0
Gastric banding	58	16.6
Sleeve gastrectomy	36	10.3
Biliary pancreatic diversion	27	7.7
Surgery unknown	5	1.4
	Mean	SD
Age at initial surgery	46.2	10.5
Pre-operative BMI	47.7	8.7
Time lapse since surgery (years)	7.3	4.3
Physical component score	46.4	11.4
Mental component score	47.8	12.7

Respondents ranged from 0–19 years post-surgery, with an average time since surgery of 7.3 years (standard deviation (SD)=4.3). Eighty-three percent of respondents were female, and 91.9 % self-identified as White or Caucasian. The average age of respondents at the time of surgery ranged between 17 and 72 years old (mean=46, SD=10.5), and the average pre-surgical BMI was 47.7 (SD=8.7). The last available BMI following surgery was, on average, 4 years prior to the completion of the survey.

The physical component score in our sample has a mean of 46.4, which is significantly lower than the normed non-obese population mean of 50 (z=−5.9079, p<0.001). Similarly, the mental component score (mean=47.8) is significantly lower than the normed non-obese population mean of 50 (z=−3.2408, p=0.001).

The type of surgery (a categorical variable) was dummy coded (with BPD as the reference group) and used in a multiple regression analysis that examined the effects of age at the

time of surgery, as well as pre-surgical BMI, time since surgery, and type of surgery, on both physical and mental component SF-36 scores. Results indicated that these variables together predict 13.5 % of the variability in physical component scores, which is statistically significant ($F=6.38$, $p<0.001$). An examination of the individual contributions of each of the variables indicates that, controlling for the other variables in the model, age at surgery, pre-surgical BMI, and time since surgery are significantly negatively related to the variability in PCS (Table 2). The type of surgery did not significantly affect the PCS.

This same model predicted a significant amount (9.2 %) of the variability in mental component scores ($F=4.14$, $p=0.001$), although time since surgery was the only significant predictor of MCS (Table 2).

Discussion

This study evaluated patients who had undergone any type of bariatric surgery over a period of two decades in order to assess predictors of health-related quality of life. Our findings are unique in that they look at the multivariate contributions of several factors on long-term quality of life outcomes. When compared to studies that examine the relationship between each of these factors individually and HRQoL, our findings are mixed. In general, longitudinal studies have shown that HRQoL follows a trend of greatest improvement within the first year after surgery, with some attenuation over time. Previous research suggests that patients demonstrated improvement in both physical and mental component scores, with sustained benefits seen over as much as 10 years [8]. Other research has suggested that the age of the patient at the time of surgery may be a new long-term prognostic factor for physical outcomes such as surgical complications and mortality [10].

Our results suggest, when taken together, age at time of surgery, pre-surgical BMI, and duration since surgery are all negatively related to the physical component of the SF-36. Thus, older patients, those with higher pre-surgical BMIs and those who had a longer duration of time since surgery, all seem to show lower long-term HRQoL outcomes when compared to the non-obese population norm. This contrasts with other studies that generally demonstrate improvement in HRQoL [2, 7, 11], Although most previous studies measuring long-term HRQoL, examined these outcomes 1, 2, or 5 years post-surgery, the average length of time since surgery in our surveyed sample was more than 7 years suggesting that shorter-term effects may actually be attenuated significantly over time. Additionally, there is often recurrence of many of the comorbidities that are concomitantly present. Scozzari's study indicates that patients who are older and have a higher BMI at the time of surgery have less desirable weight outcomes, and our results support those findings in regard to HRQoL [10]. Older patients may start off with more morbidity and mortality and may be less resilient to the stresses of surgery. Hence, it could be expected that outcomes may not be as good in older patients. Patients with severe obesity have more comorbidities and physical impairment, which may explain why higher pre-surgical BMIs result in lower long-term HRQoL.

Bariatric surgery consists of a number of procedures with varying amount of durable weight loss depending on the degree of surgical intervention. The type of surgery is heavily conflated with the amount of weight loss, which is a predictor of long-term quality of life outcomes [8]. However, our findings did not demonstrate that type of surgery was significantly related to long-term HRQoL. This would appear to corroborate the most recent findings of Strain et al., where HRQoL was not different across four types of surgeries despite the varying amount of weight loss [7].

Several strengths of the current study are important to note as they add to the current literature of long-term outcomes for patients who have undergone bariatric surgery. We looked at several factors simultaneously across surgery types and over a

Table 2 Regression coefficients for physical component score (PCS) and mental component score (MCS) analysis

	PCS		MCS	
Variable	Beta	*t*	Beta	*t*
Pre-operative BMI	−0.193	−3.19*	0.083	1.34
Age at surgery	−0.193	−3.11*	0.079	1.25
Duration since surgery	−0.273	−3.87**	−0.267	−3.70**
Type of surgery				
Gastric band	0.125	0.718	−0.100	−0.06
Gastric bypass	0.297	1.46	−0.013	−0.06
Gastric sleeve	0.162	1.00	0.009	0.06
BPD (reference group)	–	–	–	–

PCS physical component score, *MCS* mental component score, *BPD* biliopancreatic diversion

*$p<0.01$; **$p<0.001$

period of almost two decades. Another strength of our study was the inclusion of a tool to provide information that allows for comparison between disease states, enabling a less weight-centric assessment and allowing for a more universal evaluation. Additionally, there are few studies that incorporate all types of bariatric surgery for analysis; the inclusion of biliary pancreatic surgery adds unique comprehensive data. We also report novel findings that have not been available for the US population.

As in any study, there are limitations; our study lacked pre-surgical and interim assessments of HRQoL. The cross-sectional design restricted our ability to examine change in quality of life, which may have an independent natural decline over time [12], and should be viewed as a snapshot of the current status of the post-bariatric cohort. We could not evaluate change in comorbidities or trajectory of weight loss and weight regain. Attrition is a well-known barrier particularly in bariatric surgery [10]. Additionally, self-reported data may not always be reliable. While previous researchers suggest that weight loss may be the most valued outcome for patients who have had bariatric surgery, we would argue that quality of life over the long term is an important consideration that needs to be addressed with bariatric patients. We would advocate for a consensus on recommendations, guidelines, and methods of assessing quality of life, thereby allowing more accurate and comprehensive evaluations and results.

Conclusion

We conclude that while bariatric surgery is the most effective intervention for sustained weight loss, the results may not be generalized, and individual variation is often present. The concept of success of surgery will have to evolve to include aspects other than weight loss alone and should look at overall quality of life for patients who elect to undergo these procedures. Careful evaluation and enhanced counseling is critical. The best approach would be to address these issues within the personal belief system of the patient to determine and optimize overall outcomes for the welfare of the patient. Based on our findings, we would recommend that in high-risk subgroups, such as older patients and those with more severe obesity, a more detailed assessment of their current physical and mental functioning is imperative. Our study also adds to the recent literature regarding the impact of age on the prognosis of bariatric surgery. We report new data on the similar effect of the age at the time of surgery, across all four types' modalities, on both physical and mental components of HRQoL which has not previously been documented.

Conflict of Interest The authors have nothing to declare. No grants or fellowships were used to support the paper.

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