

Prospective study of health-related quality of life after Roux-en-Y bypass surgery for morbid obesity

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Background: The aim of this study was to evaluate the effects of Roux-en-Y gastric bypass for morbid obesity on health-related quality of life (QOL) during the first year of follow-up.

Methods: The World Health Organization Quality of Life – Brief (WHOQOL-BREF) was administered 1 month before operation, and at 1, 3, 6 and 12 months after surgery. Body mass index, co-morbidities and operation-related complications were measured at these times. A mixed-effect model was constructed to analyse repeated measurements and determine the relationships between body mass index, WHOQOL-BREF scores and other variables.

Results: A total of 102 patients were enrolled. The mixed-effect model showed that the physical, psychological and social domains improved after bariatric surgery, with simultaneous reduction in weight and improvement in co-morbidities. There was a dip in scores in physical and psychological domains 3–6 months after surgery, significantly related to complications. All patients gradually improved between 6 and 12 months after surgery, reaching levels similar to those of healthy subjects.

Conclusion: Health-related QOL improved dramatically after bariatric surgery, dipped slightly between 3 and 6 months, and improved again up to the end of the first year.

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Introduction

Obesity has increased markedly in recent years and it is now a major public health issue in many Western countries^{1–3}. With more Westernized dietary habits and sedentary lifestyles, obesity has also become an emerging problem in Asia⁴. In Taiwan, the prevalence of obesity is 19.2 per cent for men and 13.4 per cent for women⁵. Many obesity-related co-morbidities have been described and account for considerable medical resource use worldwide^{6–8}. In general, increases in body mass index (BMI) are correlated with poorer health-related quality of life (QOL)^{9–11}.

Although non-surgical treatments for obesity can result in weight loss of approximately 5–20 per cent of bodyweight^{12,13}, these methods are mainly ineffective in long-term resolution of excess bodyweight. Successful bariatric surgery not only helps to reduce bodyweight and co-morbidities, but it also results in an improvement in patients' health-related QOL^{9,13–19}. Little is known,

however, about changes in health-related QOL with time, probably because of difficulties in controlling for potential confounders.

The aim of this study was to evaluate the effects of bariatric surgery on changes in health-related QOL, co-morbidities and loss of excess BMI during the year after operation.

Methods

This study was approved by the Institutional Ethics Committee of E-Da Hospital, I-Shou University. All patients who came to the Bariatric Centre seeking surgical treatment for morbid obesity were invited to participate. Laparoscopic Roux-en-Y gastric bypass is the standard procedure and had been performed regularly in this hospital before the start of the study. The recommendations of the Asia–Pacific consensus⁴ were adopted, which stipulate that to be eligible for bariatric surgery patients must be

aged between 18 and 65 years with a BMI between 32 and 40 kg/m² and obesity-related co-morbid conditions, or a BMI above 40 kg/m². Exclusion criteria included previous gastric surgery, large hiatus hernia, history of alcohol or substance addiction, and poorly controlled non-obesity-related medical diseases such as unresolved depression. All patients underwent psychiatric interview and those with mental illness or unrealistic expectations for surgical treatment were excluded from the study. The presence of diabetes, heart disease, hypertension, asthma, sleep apnoea, cancer and other major co-morbid conditions, as well as educational level, marital status, employment, religion, monthly income and history of smoking or drinking, were recorded. All subjects received regular follow-up for 1 year after surgery at the Bariatric Centre.

Health-related quality of life questionnaire

The World Health Organization Quality of Life – Brief (WHOQOL-BREF)^{20–23} is a generic QOL instrument designed to assess physical, psychological, social and environment domains. It has been shown to have good validity for use across different countries²² and different patient groups, including those with morbid obesity^{10,24–27}. Every subject was asked to complete the WHOQOL-BREF, Taiwan version²⁸, in the outpatient clinic of the Bariatric Centre before the operation, and after 1, 3, 6 and 12 months. The WHOQOL-BREF is a self-completed questionnaire. It was administered by an experienced research nurse who was ready to help the subjects, should any question be raised. Subjects were encouraged to fill out every item. Questionnaires were considered effective when more than 80 per cent of items had been answered. The score of any omitted item was replaced by the average score of the other items in the same domain. The Taiwan version of the WHOQOL-BREF contains four domains (physical, psychological, social and environment), including the 26 original items of the WHOQOL-BREF, plus two Taiwanese culture-specific questions as national items. One item ‘being respected and accepted’ was categorized in the social domain and another addressing ‘eating what one likes’ was categorized in the environmental domain. The method of application, scoring procedures and reference time point (during the last 2 weeks) were the same as for the original WHOQOL-BREF 23. Each item was scored from 1 to 5 points and a higher score was considered to indicate a better QOL. Because the numbers of items were different for each domain, the domain scores were calculated by multiplying the average of the scores of all items in the domain by the same factor of four. Therefore, each domain score had the same range, from 4 to 20.

Physical evaluation

Blood pressure, complete blood count and serum biochemistry profile including aspartate aminotransferase, alanine aminotransferase (ALT), triglycerides, total cholesterol, low-density lipoprotein, high-density lipoprotein and fasting glucose were recorded before, and at 1, 3, 6 and 12 months after surgery. Bodyweight and height were measured at the same times. Abnormal liver function was defined as a serum ALT level more than two times the reference level for the E-Da Hospital. Oesophago-gastroduodenoscopy was performed to detect peptic ulcer and possible infection with *Helicobacter pylori*, which was treated before surgery. Gastro-oesophageal reflux disease (GORD) was determined by endoscopy or the presence of typical symptoms using a specific questionnaire, the Reflux Disease Questionnaire, administered before surgery and after 1, 3, 6 and 12 months. Endoscopy was performed if upper gastrointestinal bleeding, dysphagia or epigastric discomfort developed during follow-up.

Reference population

A reference group of healthy subjects matched by age (within 5 years), sex, municipality, marriage and education was randomly selected from the database of the 2001 National Health Interview Survey (NHIS)²⁹ conducted by the National Health Research Institutes and the Bureau of Health Promotion, Department of Health, Taiwan. The 2001 NHIS provided nationwide estimates about health conditions, health behaviours and the use of medical resources by the Taiwanese population. The WHOQOL-BREF, Taiwan version, was one of the tools included in this national survey. Each morbidly obese patient was matched with two reference subjects with a BMI no greater than 32 kg/m².

Statistical analysis

A descriptive analysis was conducted comparing the demographic characteristics of patients and reference subjects; χ^2 test was used for analysis of categorical variables and Student's *t* test for continuous data. Different domains of WHOQOL-BREF were summarized along with repeated measurements at different times and these were then compared with values from the normal reference population in Taiwan using Student's *t* test. Mixed-effect models were constructed assuming a linear autocorrelation for repeated measurements within individual subjects by using the summary scores for each domain and individual items as the dependent variables, whereas BMI values, time, age, sex, years of education, employment, monthly

income, marital status, co-morbidities and operation-related complications were included as independent predictive variables. All data were collected and analysed using SAS[®] software version 9.0 (SAS Institute, Cary, North Carolina, USA).

Results

All 218 consecutive patients who had surgery between January 2007 and June 2008 were invited to participate. One hundred and two patients (46.8 per cent) accepted the invitation, joined the study, and filled in the questionnaires by themselves. They underwent regular follow-up for 1 year after surgery. There were no significant differences in clinical and sociodemographic characteristics

between the participants and non-participants, including BMI (mean(s.d.) 42.3(7.0) *versus* 41.1(7.7) kg/m²), age (mean(s.d.) 32.1(9.6) *versus* 31.1(7.7) years), sex (62.7 *versus* 67.2 per cent women), marital status (32.4 *versus* 34.5 per cent married), education (61.8 *versus* 51.7 per cent educated for more than 12 years) and employment (46.1 *versus* 35.3 per cent employed).

A total of 200 healthy subjects were selected. The demographic and clinical characteristics of the 102 patients with morbid obesity and 200 healthy controls are summarized in *Table 1*. Obese subjects had a lower employment rate ($P = 0.002$) and a higher rate of co-morbidities ($P < 0.001$) than healthy controls.

Before bariatric surgery QOL scores in the physical, psychological and social domains among patients with morbid obesity were significantly lower than those of the age-, sex-, education- and municipality-matched subjects (*Table 2*). QOL scores in the physical and psychological domains increased rapidly at 1 month after operation but decreased slightly from 3 to 6 months after surgery. Both of these scores gradually improved from 6 to 12 months after operation (*Table 2, Fig. 1*). The scores in the social domain showed a marked increase during the first month, remaining steady up to 6 months followed by a gradual increase. There was no significant change in QOL scores in the environment domain (*Fig. 1*). Several individual aspects that contribute to QOL changed markedly during the year (*Fig. 2*).

The mixed-effect model demonstrated that QOL scores in the physical, psychological and social domains improved significantly after surgery, associated with a falling BMI (*Table 3*). Many items in the physical domain, including 'pain and/or discomfort', 'mobility', 'activities of daily living' and 'dependence on medication or treatments', improved in parallel with the reduction in BMI. The physical domain was affected by the occurrence of

Table 1 Demographic characteristics of patients and age-, sex-, municipality-, marriage- and education-matched healthy control subjects

	Patients with obesity (n = 102)	Healthy subjects (n = 200)	P†
Sex ratio (F : M)	64 : 38	125 : 75	0.967
Age (years)*	32.1(9.6) (18–54)	31.8(9.5) (20–55)	0.802‡
BMI (kg/m ²)*	42.3(7.0) (32–67)	23.9(3.6) (17–32)	< 0.001‡
Married	33 (32.4)	64 (32.0)	0.951
Education (years)			0.897
≤ 12	39 (38.2)	78 (39.0)	
> 12	63 (61.8)	122 (61.0)	
Employed	47 (46.1)	129 (64.5)	0.002
Monthly income (NT)			0.261
< 20 000	38 (37.3)	88 (44.0)	
≥ 20 000	64 (62.7)	112 (56.0)	
Co-morbidity	85 (83.3)	0 (0)	< 0.001

Values in parentheses are percentages unless indicated otherwise; *values are mean(s.d.) (range). BMI, body mass index; NT, new Taiwan dollar.

† χ^2 test unless indicated otherwise; ‡Student's *t* test.

Table 2 Comparison of body mass index values and health-related quality of life scores from four domains between patients with morbid obesity before and after bariatric surgery, and age-, sex-, municipality-, marriage- and education-matched healthy control subjects

	Patients (n = 102)					Healthy subjects (n = 200)	
	Time after operation (months)					BMI ≥ 25 to < 32 kg/m ² (n = 98)	BMI < 25 kg/m ² (n = 102)
	0	1	3	6	12		
BMI (kg/m ²)	42.3(7.0)	38.5(6.8)	35.0(6.1)	31.2(4.9)	28.4(6.0)	26.9(2.0)*	20.9(2.1)‡
QOL score							
Physical	13.5(2.2)	14.5(2.3)	14.5(2.2)	14.3(2.3)	14.8(2.0)	15.4(2.0)	15.6(1.6)*
Psychological	11.6(2.9)	12.9(2.7)	13.2(2.7)	12.8(3.1)	13.6(2.7)	13.6(2.3)	14.0(1.9)
Social	13.3(2.5)	14.1(2.3)	14.2(2.4)	14.2(2.5)	14.7(2.5)	13.9(2.1)†	14.7(2.1)
Environment	13.5(2.0)	13.6(1.9)	13.8(2.1)	13.8(2.1)	14.2(2.0)	13.2(2.1)‡	13.9(2.0)

Values are mean(s.d.). BMI, body mass index; QOL, quality of life. * $P = 0.022$, † $P = 0.025$, ‡ $P < 0.001$ *versus* results at 12 months after operation (Student's *t* test).

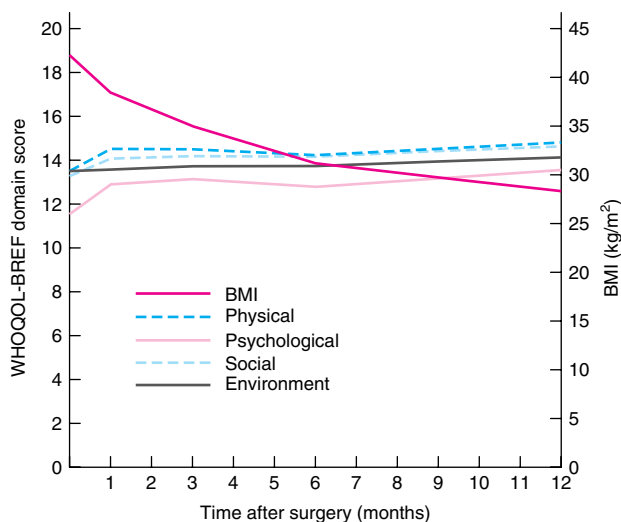


Fig. 1 Scores for physical, psychological, social and environment domains in World Health Organization Quality of Life – Brief (WHOQOL-BREF) and body mass index (BMI) changes after bariatric surgery

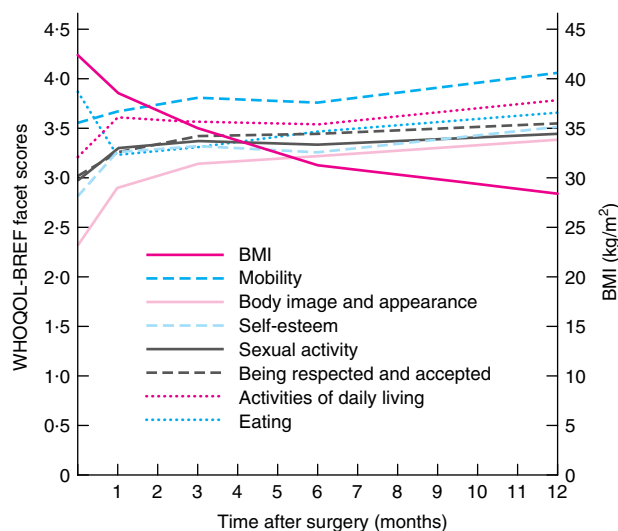


Fig. 2 Scores for specific aspects of quality of life in World Health Organization Quality of Life – Brief (WHOQOL-BREF) and body mass index (BMI) changes after bariatric surgery

operation-related complications. QOL scores in the psychological domain were reduced by the presence of morbid obesity-related co-morbidities but increased by the reduction in BMI, employment and male sex. ‘Positive feelings’, ‘self-esteem’ and ‘body image and appearance’ were the specific aspects changed by bariatric surgery through a reduction in BMI. QOL scores in the social

domain were reduced by the occurrence of co-morbidities, but increased by loss of bodyweight and employment. Two items in the social domain, ‘sexual activity’ and ‘being respected and accepted’, were improved by weight reduction and employment (*Table 3*).

At 1 year, the mean BMI improved from 42.3 to 28.4 kg/m² and the mean loss of excess BMI was 80.3 per cent. Hypertension, GORD and abnormal liver

Table 3 Regression coefficients based on mixed-effect model analysis of each domain and item of health-related quality of life in patients with morbid obesity before and after bariatric surgery

	BMI (kg/m ²)	Co-morbidity (yes/no)	Complication (yes/no)	Sex (M)	Employment (yes/no)
Physical	-0.067 (0.018)‡		-1.158 (0.352)†		
Pain and/or discomfort	-0.031 (0.010)†		-0.656 (0.224)†		
Mobility	-0.023 (0.007)†	-0.210 (0.092)*			
Activities of daily living	-0.013 (0.007)*		-0.428 (0.146)†		
Dependence on medication or treatments	-0.019 (0.008)*				
Psychological	-0.046 (0.021)*	-0.829 (0.270)†		1.071 (0.485)*	1.280 (0.524)*
Positive feelings	-0.013 (0.007)*				
Self-esteem	-0.017 (0.008)*	-0.263 (0.099)†		0.331 (0.152)*	
Body image and appearance	-0.026 (0.008)†	-0.385 (0.102)‡		0.342 (0.145)*	
Negative feelings		-0.224 (0.097)*			0.387 (0.164)*
Social	-0.039 (0.019)*	-0.586 (0.244)*			1.077 (0.436)*
Personal relationships		-0.191 (0.087)*		0.314 (0.142)*	
Sexual activity	-0.016 (0.007)*				0.364 (0.126)†
Being respected and accepted	-0.018 (0.007)†				0.263 (0.136)*
Environment					
Financial resources	-0.018 (0.008)*			0.410 (0.157)*	
Physical safety and security		-0.307 (0.103)†		0.398 (0.145)†	
Eating what one likes			-0.395 (0.184)*		

Values in parentheses are standard errors. BMI, body mass index. **P* < 0.050, †*P* 0.010, ‡*P* < 0.001 (mixed-effect model analysis).

Table 4 Effect of bariatric surgery on obesity-associated major co-morbidities

	Preop.	12 months postop.	P*
Diabetes mellitus	25 (24.5)	15 (14.7)	0.078
Hypertension	57 (55.9)	20 (19.6)	< 0.001
Gastro-oesophageal reflux disease	42 (41.2)	18 (17.6)	< 0.001
Abnormal liver function	28 (27.5)	5 (4.9)	< 0.001

Values in parentheses are percentages. * χ^2 test.

function improved significantly after bariatric surgery; although there was a fall in the number of diabetic patients, this did not reach significance (Table 4). Operation-related complications, including gastrojejunal anastomotic stricture (12 patients), gastrojejunal anastomotic ulcer (9), upper gastrointestinal bleeding (1) and GORD (2), were treated endoscopically or with appropriate medication.

Discussion

Although bariatric surgery has been shown to reduce body-weight, and improve QOL and co-morbidities^{6,8,15,30,31}, this study is the first to show the detailed impact on QOL changes in the year after surgery. A mixed-effect model analysis was used to minimize confounding. Improvements were seen in various domains and aspects of QOL for the first 3 months, after which there was a slight downward trend in physical and psychological domains between 3 and 6 months that seemed to be associated with complications, followed by further improvement up to the end of the first year. The present findings corroborate other results³⁰, showing that laparoscopic gastric bypass could improve both physical and mental health dimensions of the Short Form 36 (SF-36[®]; Medical Outcomes Trust, Waltham, Massachusetts, USA).

Once complications had been treated, QOL scores increased again from 6 to 12 months. The curve of dynamic changes in QOL scores in the psychological domain was similar to that in the physical domain. This might relate to 'self-esteem', for which scores were lowest 6 months after surgery. Scores in the social domain increased rapidly during the first month, and remained steady between 1 and 6 months after surgery. These corresponded to the sum of increased individual scores for 'being respected and accepted' and decreased scores for 'sexual activity'.

This analysis provides more detailed information to assist bariatric surgeons in controlling potential problems for patients during follow-up. For example, scores for 'pain and/or discomfort', 'self-esteem' and 'sexual activity' improve rapidly during the first 3 months after surgery, but

decrease with the appearance of complications, gradually improving again when these complications are alleviated. Surgeons might therefore look for specific procedure-related complications that tend to be troublesome between 3 and 6 months. Prompt treatment might mitigate some of the deterioration in QOL at this time. Patients can also be reassured that these aspects of QOL will improve.

The comparison between the average QOL of morbidly obese subjects and the healthy national population was informative. Although the mean physical domain score of the morbidly obese at 1 year after surgery was similar to that of control subjects whose BMI values were between 25 and 32 kg/m², it was still lower than the score for those with a BMI less than 25 kg/m². Mean scores in both psychological and social domains of the morbidly obese reached the same level as in healthy subjects whose BMI values were less than 25 kg/m².

This study has several limitations. Although the mixed-effect model controlled for most potential confounding factors associated with QOL, this study was not a randomized controlled trial so the magnitude of the possible placebo effect of surgery cannot be determined. The participation rate of 46.8 per cent raises concern about whether the sample was representative. As there were no significant differences between the participants and non-participants for most demographic factors and severity of obesity as measured by BMI, the likelihood of bias was probably small. Physical scores remained lower than those of control subjects with a BMI of less than 25 kg/m², and longer follow-up is needed before making inferences about bariatric surgery and long-term effects on QOL.

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