Quality of Life

Cost and Future of Bariatric Surgery

Edward H. Livingston, MD; Aaron S. Fink, MD

Obesity is increasing in epidemic proportions internationally.[1] Health care costs for the treatment of obesity and its complications have also increased. Recent estimates are that $70 billion or 9.4% of all health care costs are attributable to treating obesity and obesity-related complications.[2,3] As the population's weight has become heavier,[4-6] the prevalence of morbid obesity has dramatically increased.[7] Morbid obesity is associated with significant medical complications such as sleep apnea, hypertension, osteoarthritis, diabetes mellitus, and other degenerative conditions.[8-18] Although these disorders respond to weight loss, individuals who have morbid obesity rarely achieve long-term weight loss with dietary interventions.[19] Bariatric surgery remains the only method that culminates in sustained weight loss with subsequent control of obesity-related complications.[20] Bariatric surgery effectively treats obesity-induced diabetes mellitus,[21,22] hypertension,[23-26] hyperlipidemia.[27-32] osteoarthritis, pulmonary hypertension,[33] and sleep apnea.[34-36] The effects of obesity on health and, similarly, the effectiveness of bariatric surgery in treating obesity-related comorbid conditions is well documented.

From a patients' perspective, there are also significant quality of life (QOL) issues resulting from obesity. To date, QOL has received less attention from the medical community. However, QOL is considered crucially important when evaluating the effectiveness of various treatments.[37,38] Modern approaches to cost-effectiveness analysis for therapeutic intervention include not only cost considerations, but also assessments of the effect on a patients' QOL. The concept of quality adjusted life years is used when determining the overall cost-effectiveness for therapies.

Despite the obvious importance of QOL considerations when treating obese patients, there have been few studies evaluating the effect that bariatric surgery has had on QOL. We assume that surgical investigators are unfamiliar with the constructs for this field of research. For that reason, in this article, we will summarize the basic concepts of QOL research; we will review the effect obesity has on QOL; and finally, we will summarize those studies that have investigated the effect bariatric surgery has on obesity-related QOL. Also reviewed are the known costs associated with bariatric surgery.

From the Departments of Surgery, Veterans Affairs Greater Los Angeles Health Care System, Los Angeles, Calif (Dr Livingston), and Veterans Affairs Medical Center and Emory University, Atlanta, Ga (Dr Fink). Dr Livingston is now with the Department of Gastrointestinal and Endocrine Surgery, University of Texas Southwestern Medical Center, Dallas.

QUALITY OF LIFE

An individual's QOL represents their happiness and satisfaction with the physical, mental, emotional, social, and spiritual aspects of their life.[39] Every imaginable aspect of one's existence contributes to QOL. Health significantly influences QOL; health's influence on QOL is represented as the health-related QOL and is the subject of this article. For simplicity sake we will refer to health-related QOL as QOL.

Health status and health perceptions are components of QOL. Health status describes an individual's state of health in terms of being well, and if not, the degree of illness. Illness-associated morbidity in terms of physiological or functional impairment and measurements of

symptoms are incorporated in measurements of health status, which can usually be measured objectively. For example, control of hypertension or diabetes mellitus are easily measured and are examples of the traditional outcomes measured in clinical studies.

Health perceptions reflect a patient's perception of his or her disease and its effect. Health perceptions are an important measure of QOL because the effect of a disease on any individual will be a function of how he or she believes that disease affects him or her. For example, an individual with chronic diseases may be well adapted to the illness and perceive only minimal adverse effect of the disease process on the QOL. In contrast another person may perceive significant disability from relatively minor disease processes. Measurement of health perceptions are essential in evaluating results obtained from therapeutic interventions. For example, a patient with cancer who receives chemotherapy and irradiation may become so ill from the adjuvant therapy that any extended survival may be of little value because of the intervention's adverse effects. Measurement of the patient's subjective assessment of his or her therapy is equally important as measurement of the objective end points but much more difficult to achieve. Because of the complexity of measuring the subjective aspects of health care compared with more objective end points, the subjective aspects have received much less attention.

For obesity, the major objective measurement followed up in clinical studies is weight loss. A variety of subjective QOL parameters are influenced by obesity and subsequent weight loss. Decreased osteoarthritis pain can be measured with the appropriate pain scales. Obese patients typically have low self-esteem and depression, both of which improve with weight loss and are measurable with the appropriate QOL tool. From these examples, it is evident that improvements in QOL are perhaps the most significant, yet least studied, benefits from weight loss.

Functional health status measures the ability of an individual to meet his or her daily needs. The ability to walk and perform daily activities (dressing, taking a shower, performing work to sustain income, and others) are all measured as part of the functional status.

"Quality of life" is a generic term that is influenced by many aspects of daily life. Those aspects of a patient's medical condition that affect a patient are known as the health-related QOL.

MEASUREMENT INSTRUMENTS

Medical Outcomes Study SF-36

One of the most commonly used instruments for measurement of QOL is the Medical Outcomes Study 36-Item Short-Form Health Survey (MOS SF-36). This questionnaire has been used for and validated in many clinical situations and diseases. The MOS SF-36 measures the following 8 domains of QOL: (1) physical functioning; (2) role limitations caused by physical health problems; (3) bodily pain; (4) social functioning; (5) general mental health; (6) role limitations caused by emotional problems; (7) role limitations caused by loss of vitality, energy, or fatigue; and (8) general health perceptions. This instrument provides a score for each of the 8 domains and an overall physical and mental health component summary score.[40]

Nottingham Health Profile

The Nottingham Health Profile scale has been applied to bariatric surgery studies. Like the MOS SF-36, the Nottingham Health Profile scale has been validated against large populations so that for each domain measured, results may be compared with reference populations. Another benefit of the Nottingham Health Profile scale is that its results can be reduced to a single numerical value, allowing it to function as a utility index.[41] There are 6 domains measured in the 38 questions that make up this survey: energy, pain, emotional reactions, sleep, social isolation, and physical mobility.[42]

OBESITY-SPECIFIC QOL INTRUMENTS

There are many QOL measurement instruments that ask questions specific for obesity-related problems. They offer greater sensitivity to disorders occurring as a result of obesity and should provide better QOL assessment for obese individuals than is possible using generic instruments such as the MOS SF-36 or Nottingham Health Profile scales.

Impact of Weight on QOL

This instrument was developed at the Duke University diet and fitness center. It measures the following 8 domains: health, social-interpersonal interaction, work, mobility, self-esteem, sexual life, activities of daily living, and comfort with food. Using the Impact of Weight on QOL scale, it can be demonstrated that QOL is diminished with increasing weight. For women examined in the initial study, there was a greater affect of weight on reducing self-esteem and sexual life then observed for men. This instrument has 74 items and is too lengthy for most studies. Further, the Impact of Weight on QOL may be unreliable when the test is repeated at intervals longer than 1 day apart. The validation study was small and had a homogeneous population, compromising the generalizability of this instrument.[43]

Lewin–Technology Assessment Group (TAG)

The Lewin-TAG is a 55-question instrument in which two thirds of the questions were derived from a previously evaluated QOL instrument and one third were new obesity-specific questions. There are domains of general health, comparative health, overweight distress, depression, self-regard, physical appearance, health state, and preference domains with the following 4 major levels of functioning: physical attractiveness, social functioning, health distress, and emotions. The survey's strength is that it has been validated and the scales are internally consistent. However, it is unreliable when serial assessments are made in a population of patients with stable weights. The instrument is lengthy and takes a significant amount of time to administer, limiting its use.[44]

Obesity-Specific QOL

This instrument has the principal advantage of being brief (11 questions) and, therefore, easy to administer. It measures the following 4 domains: physical state, vitality and the desire to do things, relations with other people, and psychological state. Originally tested in a large cohort in France, the instrument reliably found diminished QOL associated with obesity, most especially in decreased physical functioning. Psychological and social measures were unaffected by obesity, possibly because individuals adapt to the overweight condition.[45]

Obesity-Related Well-being Scale

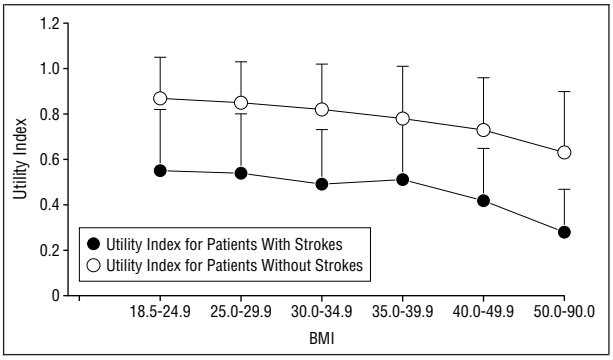
Like the Obesity-Specific QOL, the Obesity-Related Well-Being Questionnaire correlates physical symptoms but not psychosocial effects with obesity. The 18 questions in this survey measure 2 major effects: (1) psychological status and social adjustment and (2) physical symptoms and impairment. When the test is repeatedly administered, scores are consistent, demonstrating reliability. Because it has few questions, the Obesity-Related Well-Being Questionnaire is easily administered and, therefore, amenable to use for clinical studies performed in an office-based setting.[46]

Obesity Adjustment Survey–Short Form

The Obesity Adjustment Survey–Short Form has the advantage of having been developed in a population of patients undergoing bariatric surgery. The population was massively obese and then lost weight after undergoing gastroplasty. A survey with 95 questions from the Mental Health Inventory, the Sickness Impact Profile, and the Eating Inventory were administered both before and after bariatric surgery in a cohort of massively obese patients. These surveys are all psychological QOL instruments. From these 95 questions, 20 were identified that change significantly with weight loss and, therefore, are sensitive measures of obesity. These 20 questions measure overall obesity adjustment and psychological distress domains. One major limitation is that obesity-related psychological distress is the only aspect of QOL measured. There is an advantage in that several of the other obesity-specific surveys are insensitive to the effect obesity has on psychological well-being. However, the other obesity-specific QOL instruments demonstrate profound negative effects on physical functioning with increased obesity, measures that are absent in the Obesity Adjustment Survey–Short Form.[47]

BARIATRIC SURGERY AND QOL

The psychosocial ramifications of obesity are significant. In a society that idealizes thinness, overweight individuals cannot avoid feeling as if they are outcasts. Aside from body image issues, obese persons cannot always fit into conventional chairs in public places, get on airplanes, or undertake ordinary activities easily done by the nonobese population. In general, society views obese persons as having poor self-control with problems brought on themselves. On the contrary, obese persons often perceive that they eat the same amounts and types of foods as normal-sized individuals, yet remain overweight. These circumstances culminate in depression and poor self-esteem characteristic of the obese population. Because obesity is a chronic disease, patients tend to adapt psychologically. Consequently, generic QOL instruments may not detect obesity-related decrements in QOL. For this reason, it is important to use QOL measuring instruments with obesity-specific queries to detect the effect obesity has on QOL.[48]



Effect of body mass index (BMI) (calculated as weight in kilograms divided by height in meters squared) and stroke on a quality of life (QOL) utility index. Using the HALex (Health Activities and Limitations Index) utility index, there was a progressively decreasing QOL with increased BMI. Super obese individuals had a QOL nearly as bad as normal weight individuals who have had a stroke. Increasing BMI resulted in a proportionate decrease in QOL after stroke without any interaction (ie, reductions in QOL are an independent function of BMI and there is no synergy between being obese and having a stroke). Reproduced with permission from Livingston and Ko.[49]

Obesity severely degrades QOL. When measuring QOL with a *utility index*, that is, a measure that reduces the QOL measurement to a single number, there is a linear decrease in measured QOL with increasing weight. Obesity itself reduces QOL to the same degree as other nonobesity-related causes of severe, debilitating illness such as stroke, heart attack, and others. Irrespective of how diminished QOL is reduced by a disease, concurrent obesity reduces QOL in proportion to a patient's weight (**Figure**).[49] One can derive a sense of the effect obesity has on patients by asking them to chose among various possible, preferred health states. On inquiry, obese persons stated they would prefer to have a normal weight and size rather than be an obese millionaire. Obese individuals would rather have a normal weight with a severe disability such as be deaf, have heart disease, have an amputation, and others rather than be obese without any of these conditions.[50] These extreme responses are demonstrative of the severe negative effect obesity has on QOL (**Table**).

In clinical practice, obese patients willingly make QOL compromises to treat obesity. Patients undergoing malabsorptive operations develop foul-smelling flatus and diarrhea. When assessed in terms of QOL, they reported that these problems interfered with their activities or caused embarrassment when in public. Despite these consequences, patients undergoing these operations stated that their overall QOL improved in terms of interpersonal relationships, physical and emotional well-being, and sexual function. Studies such as these highlight the severe adverse effect obesity has on QOL; even

Summary of Quality of Life (QOL) Clinical Trials Evaluating the Effect of Surgery*

Source	Type of Operation	Length of Follow-up, mo	% of Follow-up	Study Design	Main Effect
Rand and Macgregor,[50] 1991	Restrictive procedures	36	NA	Retrospective	Distress
Rae and Cleator,[51] 1993	Ileogastrostomy	25	77	Retrospective	Multiple QOL improvements despite significant adverse effects from malabsorption
Hawke et al,[52] 1990	Restrictive procedures	36	77	Prospective	Improved employability, happiness, and self-image at the expense of increased smoking
van Gemert et al,[53] 1998	VBG and RYGB	86	NA	Cross-sectional	Improved mobility and employability; effects decrease with time
Choban et al,[54] 1999	RYGB	18	66	Prospective	Multiple domains improve with some exceeding measures for control populations
Temple et al,[55] 1995	RYGB	6	100	Prospective	RYGB improved QOL more than any other general surgical operation
Hafner et al,[56] 1991	Restrictive procedures	NA	70	Retrospective	Improved sexual function, difficulty adjusting to new eating pattern immediately following surgery
Freys et al,[57] 2001	LASBG	24	39	Prospective	Improved QOL despite high complication rate
Dixon et al,[58] 2002	LASBG	12	47	Prospective	Greatest preoperative disability is in physical functioning that is restored following weight loss
Nguyen et al,[59] 2001	Laparoscopic and open RYGB	12	100	Randomized prospective	Similar improvement in QOL with both procedures
Dymek et al,[60] 2002	RYGB	12	NA	Cross-sectional	Improved QOL observed within weeks of surgery

Abbreviations: LASBG, laparoscopic adjustable Siliatic gastric banding; NA, not applicable; RYGB, Roux-en-Y gastric bypass; VBG, vertical band gastroplasty.
*Values refer to the percentage of patients available for follow-up relative to the initial number of patients who were enrolled in the study.

when bariatric surgery causes significant adverse effects, the improvement in QOL is significant enough to overshadow any ill effects of the operation.[51]

There is a significant relationship between poverty and obesity. Both are independent predictors of diminished QOL.[61] Surgically induced weight loss can improve one's employability and, consequently, raise an individual's socioeconomic status. It has been demonstrated that 3 years following surgically induced weight loss self-image, happiness, and social and sex lives were all markedly improved albeit at the expense of increased smoking and drinking. While only 91 (38%) of 240 patients were employed before surgery, 144 (60%) had full or part-time employment after surgically induced weight loss.[52] Significantly improved employability after weight loss surgery has been observed in other studies.[53]

Cross-sectional analysis comparing QOL in obese individuals with those who had lost weight following bariatric surgery demonstrated that QOL was significantly better for those who underwent bariatric surgery.[53] In a longitudinal QOL analysis, Choban et al[54] studied 79 patients undergoing Roux-en-Y gastric bypass. Of these 54 (69%) were available for follow-up 1 year after their surgery, typical of the follow-up for most Roux-en-Y gastric bypass series from the United States. These patients all completed an MOS SF-36 before and after surgery. Preoperatively, this cohort's QOL was markedly depressed compared with the normal reference population for the MOS SF-36. The scores indicated the extent of depressed QOL was greater for the physical rather than the mental health measures. Following bariatric surgery most of the scores for the QOL measures improved. During the plateau period in which weight loss stabilized, the QOL measures were not only improved relative to their preoperative levels, but also were quantitatively better than the nonobese reference population.[54] Exceeding the reference values for the QOL measures is consistent with the euphoria commonly observed after Roux-en-Y gastric bypass–induced weight loss. The major strength of this analysis was the use of an established QOL instrument that enabled comparison of the effects of obesity and bariatric surgery–induced weight loss with the normal population.

Application of the MOS SF-36 to patients before and after they underwent general surgical operations demonstrated significant QOL improvements following cholecystectomy, hemorrhoidectomy, and hernia repair. However, patients who underwent Roux-en-Y gastric bypass experienced the most significant improvements in QOL.[55] Cholecystectomy, hemorrhoidectomy, and hernia repair are all performed for pain. Quality of life improves more for patients undergoing bariatric surgery than for those having surgery for painful diseases. This highlights the fact that obesity substantially reduces QOL more than that from other debilitating diseases.

Following surgical intervention, there will be some discomfort and pain that reduces the QOL in the perioperative period. For the first 2 to 3 months after gastric restrictive surgery patients had difficulties adjusting to their new eating restrictions. However, once the wounds have healed, the postoperative pain has resolved, and the weight has been lost, there was a marked improvement in the ability to perform various physical activities, especially sexual functions.[56] By minimizing the effect of an incision, laparoscopic operations should result in more rapid, and possibly greater, improvements in QOL relative to open procedures. However, QOL studies following laparoscopic procedures have been difficult to evaluate. Following laparoscopic adjustable Silastic gastric banding, QOL improved with weight loss as expected. However, there was a significant complication rate of 38% and revision rate of 32%. Although a setback for pa-

tients, complications did not have a lasting negative effect on QOL. Once patients recovered from their complications, weight loss and QOL were the same as for those patients not experiencing perioperative complications.[57] The MOS SF-36 evaluation of patients who had a Lap-Band (BioEnterics; Inamed Health, Santa Barbara, Calif) inserted demonstrated favorable improvements in QOL[58] in a large cohort of Australian patients. Unfortunately, the US experience with this procedure does not seem to have the same favorable outcomes as are experienced in Australia.[62]

In a randomized trial comparing laparoscopic to open gastric bypass, QOL was assessed by the MOS SF-36 and an obesity-specific QOL instrument. At 1 month postoperatively, patients undergoing the laparoscopic operation exhibited better QOL scores than did patients undergoing the open operation. However, at 6 months postoperatively, both groups became equivalent to each other and to national norms. The Bariatric Surgery–Specific Scale (or BAROS [Bariatric Analysis of Reporting Outcome System]) was associated with slightly better QOL scores for patients who underwent laparoscopic rather than open gastric bypass at 6 months postoperatively. Although this study demonstrated better results for patients undergoing the laparoscopic operation, those undergoing open procedures had outcomes less favorable than those reported from other studies. The open approach group had prolonged operations (mean operating room time, 196 minutes), excessive blood loss (mean blood loss, 395 mL), significant intensive care unit use (16 [21%] of 76 patients were admitted to the intensive care unit), and a high reoperation rate (6.6%, 5/76). Although laparoscopic surgery would be expected to greatly improve QOL relative to open procedures, this proved not to be the case when a randomized-controlled trial was performed. There was only a modest improvement in QOL scores for patients undergoing the laparoscopic operation. The study was also limited in that many more patients who underwent laparoscopic surgery returned the QOL surveys than did those who underwent open procedures. This fact biases the results toward the laparoscopic group, given that patients satisfied with their outcomes are more likely to participate in QOL studies than those who are dissatisfied.[59]

Obesity is a chronic disease. As such, outcomes studies should examine results for many years after an intervention. Unfortunately, few studies of bariatric surgery accomplish this. There is a pressing need for long-term studies assessing the results of bariatric surgery. The QOL studies should be performed for several years after these surgical procedures. Nevertheless, there is enough information in the literature to suggest that QOL is significantly reduced by obesity and that surgically induced weight loss significantly improves QOL.

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Corresponding author and reprints: Edward H. Livingston, MD, Department of Gastrointestinal and Endocrine Surgery, University of Texas Southwestern Medical Center, 5323 Harry Hines Blvd, Room E7-126, Dallas, TX 75390-9156 (e-mail: elivings@earthlink.net).

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