

Interdisciplinary European Guidelines for Surgery for Severe (Morbid) Obesity

Martin Fried¹; Vojtech Hainer²; Arnaud Basdevant³; Henry Buchwald⁴; Mervyn Deitel⁵; Nicholas Finan⁶; Jan Willem M. Greve⁷; Fritz Horber⁸; Elisabeth Mathus-Vliegen⁹; Nicola Scopinaro¹⁰; Rudolf Steffen¹¹; Constantine Tsigos¹²; Rudolf Weiner¹³; Kurt Widhalm¹⁴

¹Prof. Dr. Martin Fried, PhD, Clinical Center for Minimally Invasive and Bariatric Surgery, Prague, Czech Republic, 1st Medical Faculty, Charles University, Prague, Czech Republic; ²Prof. Dr. Vojtech Hainer, PhD, Institute of Endocrinology, 1st and 3rd Medical Faculty, Charles University, Prague, Czech Republic; ³Prof. Dr. Arnaud Basdevant, INSERM, U755 Nutriomique, University of Paris and AP-HP, Hôtel-Dieu Hospital, Paris, France; ⁴Prof. Henry Buchwald, MD, PhD, Department of Surgery, University of Minnesota, USA; ⁵Dr. Mervyn Deitel, MD, CRCSC, FICS, FACN, Editor-in-Chief, OBESITY SURGERY, Toronto, Canada; ⁶Dr. Nicholas Finan, Wellcome Clinical Research Facility Addenbrooke's Hospital and Senior Clinical Research Associate, University of Cambridge School for Clinical Medicine, UK; ⁷Prof. Dr. J.W.M. Greve, Department of Surgery University Hospital Maastricht, The Netherlands; ⁸Dr. Fritz Horber, PD, Klinik Lindberg AG, Winterthur, Switzerland; ⁹Prof. Dr. Elisabeth Mathus-Vliegen, PhD, Academic Medical Centre, Department of Gastroenterology and Hepatology, University of Amsterdam, The Netherlands; ¹⁰Prof. Dr. Nicola Scopinaro, Professor of General Surgery, University of Genoa, San Martino University Hospital, Genoa, Italy; ¹¹Dr. Rudolf Steffen, PD, FMH, Beau-Site Clinic Berne, Hirslanden Group, Switzerland; ¹²Prof. Dr. Constantine Tsigos, PhD, Endocrinology, Metabolism and Diabetes Unit, Evgenidion Hospital, University of Athens Medical School, Athens, Greece; ¹³Prof. Dr. R. Weiner, PhD, Sachsenhausen Hospital and Center for Minimally Invasive Surgery, Johan Wolfgang Goethe University Frankfurt am Main, Germany; ¹⁴Prof. Dr. Kurt M. Widhalm, Department of Pediatrics, Nutrition and Metabolism, Medical University of Vienna, Austria

Foreword

In 2005, for the first time, an expert panel named "The Bariatric Scientific Collaborative Group" (BSCG), was appointed through a joint effort of the major European Scientific Societies which are active in the field of obesity management. Societies that constituted this panel were: International Federation for the Surgery of Obesity – European Chapter (IFSO-EC), European Association for the Study of Obesity (EASO), European Childhood Obesity Group (ECOG) and the International Obesity Task Force (IOTF) which was represented during the completion process by its representatives.

The BSCG was composed of officers representing the respective Scientific Societies (including four acting Presidents, two past Presidents, one Honorary President, and three Executive Directors). The panel was also balanced by the presence of many other opinion leaders in the field of obesity. The BSCG composition allowed coverage of the key disciplines in comprehensive obesity management, as well as being reflective of European geographic and ethnic diversity.

This joint BSCG Expert Panel has convened several meetings which were entirely focused on guideline creation during the past 2 years. There was a specific effort to develop and concur on clinical guidelines which reflect current knowledge, expertise and evidence-based data on treatment of morbid obesity.

Introduction

The prevalence of obesity is increasing world-wide at an alarming rate. Obesity has reached the proportion of a global epidemic in both developed and developing countries.¹ According to data published by the International Obesity Task Force, at least 1.1 billion adults are overweight and 312 million of them are obese. Prevalence of obesity (BMI ≥ 30) in Europe is reported in the range of 10-20% in men and 15-25% in women, and almost half of the European population is overweight or obese (BMI ≥ 25).² Overweight and obesity are associated with increased risks of type 2 diabetes, hypertension, cardiovascular disease, dyslipidemia, arthritis, non-alcoholic steatohepatitis, gallbladder disease, sleep-apnea syndrome and several cancers.³

Overweight and obesity play a crucial role in the development of type 2 diabetes. The risk of diabetes attributable to overweight and obesity is 64% for men and 77% for women.^{4,5}

Increasing body weight impairs quality of life (QoL) and reduces life expectancy. Mortality attributable to excess weight is a serious public health problem in Europe, where about 7.7% of all deaths are related to excess weight. Thus, at least one in 13 annual deaths in the EU are likely to be related to excess weight.⁶

The prevalence of morbid obesity (body mass index ≥ 40 kg/m²) in the U.S. in 2002 was 1.8%; 60% of morbidly obese people were women, and 63% were ages 18 to 49 years.⁷

Mortality increases with increasing BMI. Relative risk of death at the age of 50 years among men and women with BMI >40 who have never smoked is 3.82 and 3.79 respectively.⁸ Among severely obese young men, mortality rate is 12 times that of young normal-weight men.⁹

Severe obesity with its health and psychosocial consequences substantially increases not only the health costs but also the socioeconomic burden. Annual direct health-care costs of the severely obese (BMI ≥ 35) are three times higher than those of normal-weight subjects.¹⁰ Bariatric surgery has proved to be the most effective mode of treatment for morbidly obese patients.¹¹ Recent long-term studies show, that there is a substantial reduction in mortality after bariatric surgery, as well as decreased risk of developing new health-related co-morbidities,

decreased health-care utilization and decreased direct health-care costs.¹²⁻¹⁴ Bariatric surgery is an established and integral part of the comprehensive management of morbidly obese patients.

These Guidelines were created by an inter-disciplinary collaboration of key authorities from international medical and surgical societies (IFSO, IFSO-EC, EASO, IOTF, ECOG) in the field of obesity. The aim of the Guidelines is to provide physicians, health-care policy makers, and health-care carriers and insurance companies with essential elements of good clinical practice in the treatment of morbid obesity. Scientific data to support conclusions of this panel of experts were systematically searched in databases such as Medline (PubMed) and the Cochrane library. Searches spanned from January 1980 until December 2005, and were carried out with the help of an expert in library science, together with a clinical expert with experience in systematic reviews.

The key search words were: *obesity, obesity surgery, morbid obesity, surgical treatment, bariatric surgery, morbid obesity surgery, gastroplasty, gastric bypass, Roux-en-Y, gastric banding, biliopancreatic diversion, duodenal switch, biliopancreatic bypass, obesity/morbid obesity treatment outcomes, obesity/morbid obesity follow-up, obesity/morbid obesity complications.*

Some of the evidence level data were retrieved as well from following publications: Commonwealth of Massachusetts Betsy Lehman Center for Patient Safety and Medical Error Reduction Expert Panel on Weight Loss Surgery,¹⁵ Obesity Surgery evidence-based guidelines of the European Association for Endoscopic Surgery (EAES),¹⁶ Maggard's et al Meta-analysis: Surgical Treatment of Obesity,¹⁷ and Recommendations Regarding Obesity Surgery.¹⁸

The panel's recommendations are supported by the best available evidence, which includes all evidence levels (Randomized controlled trials - RCTs, systematic reviews of cohort studies, observational "outcomes" studies, and expert opinion). To grade the quality of evidence, the panel adopted the "Oxford Centre for Evidence-based Medicine classification system" based on levels of evidence and "grades of recommendations" according to the study designs and critical appraisal of prevention, diagnosis, prognosis, therapy, and harm studies. The Oxford classification system has four **Levels of Evidence (EL)**:

- Level A: consistent Randomised Controlled

Clinical Trial, Cohort Study, All or None, Clinical Decision Rule validated in different populations.

- Level B: consistent Retrospective Cohort, Exploratory Cohort, Ecological Study, Outcomes Research, Case-Control Study; or extrapolations from level A studies.
- Level C: Case-series Study or extrapolations from level B studies.
- Level D: Expert opinion without explicit critical appraisal, or based on physiology, bench research or first principles.

Indications for Bariatric Surgery

Patients aged 18-60 years:

- 1) with BMI ≥ 40 kg/m²;
- 2) with BMI 35-40 kg/m² with co-morbidity in which surgically-induced weight loss is expected to improve the disorder (eg. metabolic disorders, cardio-respiratory disease, severe joint disease, obesity-related severe psychological problems); (EL: A, B, D. Ref. 19-37)
- 3) BMI criterion may be current BMI or a documented previous BMI of this severity. Note that:
 - a. weight loss as a result of intensified treatment prior to surgery (patients that reach a body weight below the required BMI for surgery) is NOT a contraindication for the planned bariatric surgery;
 - b. bariatric surgery is indicated in patients who exhibited a substantial weight loss in a conservative treatment program but started to regain weight.

In order to be considered for surgery, patients must have failed to lose weight or to maintain long-term weight loss, despite appropriate non-surgical medical care. (EL: B, D. Ref. 20, 37) Patients must have shown compliance with medical appointments.

Bariatric Surgery in the Adolescent

Bariatric surgery in children and adolescents could be considered in centres which have extensive experience with such treatment in adults and are able to offer a true multi-disciplinary approach that involves paediatric skills relating to surgery, dietetics and psychological management.

In adolescents with severe obesity, bariatric sur-

gery can be considered if the patient:

- 1) has a BMI >40 (or 99.5th percentile for respective age) and at least one co-morbidity;
- 2) has failed at least 6-12 months of organized weight-reducing attempts in a specialized centre;
- 3) shows skeletal and developmental maturity;
- 4) is able to commit to comprehensive medical and psychological evaluation before and after surgery;
- 5) is willing to participate in a postoperative multi-disciplinary treatment program;
- 6) can access surgery in a unit with specialist paediatric support (nursing, anaesthesia, psychology, postoperative care). (EL: C, D. Ref. 38-45)

Bariatric surgery can be considered in genetic syndromes, such as Prader-Willi syndrome, only after careful consideration of an expert medical, paediatric and surgical team.

Bariatric Surgery above Age 60

The indication for bariatric surgery above age 60 years should be considered on an individual basis. Proof of a favourable risk:benefit ratio must be demonstrated in elderly or ill patients, before surgery is contemplated in such individuals. In elderly patients, the primary objective of surgery is to improve QoL, even though surgery may be unlikely to increase life-span. (Ref. 46)

Contra-indications Specific to Bariatric Surgery

- 1) Absence of periods of identifiable medical management;
- 2) A patient who is unable to participate in prolonged medical follow-up;
- 3) Non-stabilized psychotic disorders, severe depression and personality disorders, unless specifically advised by a psychiatrist experienced in obesity;
- 4) Alcohol abuse and/or drug dependencies;
- 5) Diseases threatening life in the short-term;
- 6) Patients who are unable to care for themselves and have no long-term family or social support that will warrant such care.

Preoperative Evaluation of the Patient

A decision to offer surgery should follow a comprehensive interdisciplinary assessment. The core team providing such assessment should optimally consist of the following specialists, experienced in obesity management and bariatric surgery:

- physician
- surgeon
- anaesthetist
- psychologist or psychiatrist
- nutritionist and/or dietitian
- nurse practitioner / social worker

Patients indicated for bariatric surgery should undergo routine preoperative assessment as for any other major abdominal surgery.

(EL: B, C, D. Ref. 16, 20, 47-54)

Preoperative management should include:

- Assessment of general health and nutritional status (see below);
- Explanation of the dietary changes that are required after surgery;
- Optimizing treatment of co-morbidities to reduce the risks of the surgical procedure;
- Assessment of patient motivation and willingness to adhere to follow-up programs;
- Ensuring that the patient is fully informed of the benefits, consequences and risks of the surgical options and the necessity of life-long follow-up;
- Ensuring that the patient understands the potential (limited) outcomes of surgery;
- Ensuring that the patient can give truly informed consent including a statement on risks of the surgery and acceptance of behaviour modification of lifestyle and of follow-up.

In addition to the routine preoperative assessment as for any other major abdominal surgery, the patient may undergo further assessment (depending on the planned bariatric operation and the patient's clinical status):

- Sleep apnoea syndrome and pulmonary function;
- Metabolic and endocrine disorders;
- Gastro-oesophageal disorders (*Helicobacter*);
- Body composition (densitometric assessment);
- Bone density;
- Indirect calorimetry.

(EL: A, B, C, D. Ref. 16, 55-69)

Overview of Surgical Techniques

Definition

- Food limitation (restrictive) operations
- Vertical banded gastroplasty (VBG)
- Gastric sleeve resection
- Gastric banding
 - adjustable (AGB)
 - non-adjustable
- Gastric bypass (GBP)
 - proximal
 - long-limb
- Operations limiting absorption of nutrients and energy
- Biliopancreatic diversion (BPD)
- Combined operations
- Biliopancreatic diversion with duodenal switch (BPD-DS)
- Distal gastric bypass (common limb ≤ 100 cm)

Laparoscopic technique should be considered as the first treatment choice in bariatric surgery, unless specific contraindications to a laparoscopic operation are present.

Assigning a Patient to a Particular Bariatric Procedure

At this moment, there are no sufficient evidence-based data to suggest how to assign a patient to any particular bariatric procedure. Among others, pre-operative factors that could influence the choice of the type of operation are:

- BMI
- Age
- Gender
- Body fat distribution
- Type 2 diabetes mellitus
- Dyslipidaemia
- Binge eating disorders (BED)
- Low IQ
- Significant hiatal hernia
- Gastro-oesophageal reflux disease
- Patient's expectations/realistic goals

The expected average weight loss and weight maintenance increases with the following procedures: AGB, VBG, GBP, BPD-DS, BPD.

On the contrary, the surgical complexity and potential surgical and long-term metabolic risks of procedures decrease in reverse order. (EL: A, B, C, D. Ref. 17, 71-95)

The procedures should be performed in interdisciplinary obesity management centres with appropriately trained staff and adequate equipment (see below). In all situations, the bariatric surgeon's experience is a key issue. It is not advisable to practice bariatric techniques on an occasional basis.

If the patient is expected to benefit more from a particular procedure not available in a specific centre, he/she should be referred to a centre/surgeon with adequate bariatric experience in that procedure. (EL: B, D. Ref. 20, 96-103) As a result of successful bariatric treatment, further treatment (such as plastic / reconstructive surgery) may be required.

Follow-up

Morbid obesity is a life-long disease. The treating physician, together with the treating surgeon, are responsible for the treatment of co-morbidities before the operation and for the follow-up after the operation. Complementary follow-up pathways (surgery and medical) should be provided to all patients, ideally in part through interdisciplinary joint clinics. The surgeon is responsible for all possible short- and long-term events directly related to the operation. The medical physician will be responsible for the long-term post-surgery follow-up and management of the obesity and obesity-related diseases and operation-related non-surgical consequences. Treatment outcome is significantly dependent, among other factors, on patient compliance with long-term follow-up.

During the rapid weight loss, special care must be taken for:

- Possible deficiencies, such as vitamin, protein, other micronutrients;
- Adjustments of medical treatment of the obesity-related morbidities, such as diabetes, hypertension, etc.

All patients after bariatric procedures require regular life-long qualified surveillance. Patients must have access to a 24-hour emergency service provided by the operating centre. The patient must take life-long responsibility for adhering to the follow-up rules.

Minimal Requirements for Follow-up after Food Limitation Operations

The patient should be provided with written information about the procedure and the exact type of

received implant (if applicable), together with a description of possible serious adverse effects.

• Adjustable gastric band

- Follow-up during the 1st year should be at least every 3 months, starting 1 month postoperatively, until a clinically satisfactory rate of weight loss is achieved, if necessary with repeated band fills. Thereafter, follow-up should be not less than at yearly intervals;

- Metabolic and nutritional status should be regularly monitored to prevent vitamin deficiencies and allow appropriate supplementation, as well as to monitor response to surgery and weight loss and adjust concomitant drug treatment;

- Band adjustments should be performed

- according to the individual patient's weight loss and the type of implant;
- first inflation according to the type of band;
- as a medical/clinical decision;
- by trained medical or paramedical staff with adequate experience (such as surgeon, medical physician, nurse practitioner, dedicated radiologist);

- Supplementation of vitamins and micronutrients should compensate for their possible reduced intake;

• VBG, non-adjustable gastric banding, and other pure gastric restrictive operations

- Similar recommendations as for adjustable gastric banding, except there will be no band adjustments

• Gastric bypass

- check-up after 1 month, minimal follow-up to be every 3 months the first year, every 6 months the second year, and annually thereafter;

- Vitamin and micronutrient supplements (oral) should be routinely prescribed to compensate for their possible reduced intake and absorption;

- Laboratory tests to evaluate the metabolic and nutritional status should be carried out annually to include fasting glucose (HbA1c in diabetics), liver function tests, renal function, vitamin B₁₂, 25-(OH) vitamin D3, ferritin, calcium, parathyroid hormone, albumin, Hb, Mg⁺⁺, zinc;

- As a result of these tests, it may be necessary to correct deficits by parenteral administration of vitamins and micronutrients;

- In the case of secondary lactose intolerance, replace with oral lactase;

- In the case of early dumping syndrome, hydration before meals is advised and the use of corn-starch supplements considered;

- In the case of late dumping syndrome, hypoglycaemia should be considered and the patient advised accordingly.

Minimal Requirements for Follow-up after Operations Limiting Absorption of Nutrients

• Biliopancreatic diversion

- Check-up after 1 month, followed by minimal follow-up every 3 months after the operation in the first postoperative year, every 6 months in the second year, and annually thereafter;
- Laboratory tests are necessary to evaluate the course of metabolic and nutritional status and to adapt supplementation and drug treatment accordingly;
- Blood tests at 1, 4 and 12 months, thereafter annually
 - liver function tests (GPT, γ GT);
 - complete blood cell count;
 - minimal nutritional parameters should be vitamin B₁₂, 25-(OH) vitamin D3, PTH, bone alkaline phosphatase, ferritin, Ca, albumin, transferrin, creatinine, prothrombin time (PTT);
 - urine examination;
- Life long daily vitamin and micronutrient supplementation (vitamins should be administered in a water-soluble form). Vitamins A, D, E, K;
- Ca supplementation (preferably in Ca citrate, recommended total intake 2 grams/day);
- Minimum advised protein intake of ~90 grams per day;
- Supplement of vitamins and micronutrients should compensate for their possible reduced intake and according to laboratory values
 - in a preventive regimen, the supplementation can be administered orally;
 - for correction of deficits, the supplementation should be administered parenterally, except for Ca;
- PPI/H2 blockers for the entire first postoperative year.

In case of excess bloating, flatulence and/or foul-smelling stools, the recommended treatments are oral neomycin or metronidazole or pancreatic enzymes. (EL: A, B, C, D. Ref. 18, 104-131)

Failed treatment

To reinforce adherence to lifestyle changes and weight loss maintenance after bariatric surgery, regular contacts and life-long follow-up with the obesity management centre are usually required. Scientific evidence reveals that a certain number of bariatric patients will fail to lose weight, or to maintain weight loss. If medically indicated and if such a patient is willing, further bariatric surgery should be undertaken. (EL: B, C, D. Ref. 132-145)

Conclusion

The BSCG members who created the Guidelines realize that they have only touched upon basic points of treatment of morbid obesity. There are many other areas in this field which were deliberately left open. Among such areas are definitions of Centres of Excellence, the bariatric surgeon's qualifications, and acceptance of the disease/reimbursement issues. These issues will be the subject of the future work of the BSCG. The authors trust that these Guidelines will improve both, medical and surgical care of morbidly obese individuals and will contribute to better outcomes and increased patient safety.

References

1. Obesity: Preventing and managing the global epidemic. Report of a WHO consultation. WHO Technical Report Series 894, Geneva, 2000.
2. James WPT, Rigby N, Leach R. The obesity epidemic, metabolic syndrome and future prevention strategies. *Eur J Cardiovasc Prev Rehabil* 2004; 11: 3-8.
3. Haslam DW, James WPT. Obesity. *Lancet* 2005; 366: 1197-1209.
4. Chan JM, Rim EB, Colditz GA et al. Obesity, fat distribution, and weight gain as risk factors for clinical diabetes in men. *Diabet Care* 1994;17: 961-969.
5. Colditz GA, Willett WC, Rotnitzky A et al. Weight gain as a risk factor for clinical diabetes mellitus in women. *Ann Intern Med* 1995;122: 481-486.
6. Banegas JR, Polez-Garcia E, Gutierrez-Fisac JL et

- al. A simple estimate of mortality attributable to excess weight in the European Union. *Eur J Clin Nutr* 2003; 57: 201-208.
7. Poulouse BK, Holman MD, Zhu Y et al. National variations in morbid obesity and bariatric surgery use. *J Am Coll Surg* 2005; 201: 77-84.
 8. Adams KF, Schatzkin A, Hartus TB et al. Overweight, obesity, and mortality in a large prospective cohort of persons 50 to 71 years old. *N Engl J Med* 2006; 355: 763-468.
 9. Drenick EJ, Bale GS, Seltzer F et al. Excessive mortality and cause of death in morbidly obese men. *JAMA* 1980; 243: 443-444.
 10. Von Lengerke T, Reitmeir P, John J. Direct medical costs of (severe) obesity: a bottom-up assessment of over- vs. normal-weight adults in the KORA-study region (Augsburg, Germany). *Gesundheitswesen* 2006; 68: 110-115.
 11. National Conference of State Legislatures, Vol. 13, No. 32. (www.ncsl.org)
 12. Buchwald H. Bariatric surgery for morbid obesity: health implications for patients, health professionals, and third-party payers. *J Am Coll Surg* 2005; 200: 593-604.
 13. Buchwald H, Avidor Y, Braunwald E et al. Bariatric surgery: A systematic review and meta-analysis. *JAMA* 2004; 292: 1724-1737.
 14. Canello R, Henegar C, Viguier N et al. Reduction of macrophage infiltration and chemoattractant gene expression changes in white adipose tissue of morbidly obese subjects after surgery-induced weight loss. *Diabetes* 2005; 54: 2277-2286.
 15. Special Report: Commonwealth of Massachusetts Betsy Lehman Center for Patient Safety and Medical Error Reduction Expert Panel on Weight Loss Surgery. *Obes Res* 2005; 13: 205-305.
 16. Sauerland S, Angrisani I, Belachew M et al. Obesity Surgery. Evidence based guidelines of the EAES. *Surg Endosc* 2005; 19: 200-221.
 17. Maggard MA, Shugarman ML, Suttorp M et al. Meta-Analysis: Surgical treatment of obesity. *Ann Intern Med* 2005; 142: 547-559.
 18. Laville M, Romon M, Chavrier G et al. Recommendations Regarding Obesity Surgery. *Obes Surg* 2005; 15: 1476-1480.
 19. Gastrointestinal surgery for severe obesity. National Institutes of Health Consensus Development Conference Draft Statement. *Obes Surg* 1991; 1: 257-265.
 20. Ridley N. Expert panel on weight loss surgery – Executive report. *Obes Res* 2005; 13: 206-226.
 21. Andersen T, Backer OG, Stokholm KH et al. Randomized trial of diet and gastroplasty compared with diet alone in morbid obesity. *N Engl J Med* 1984; 310: 352-356.
 22. Andersen T, Stokholm KH, Backer OG et al. Long term (5-year) results after either horizontal gastroplasty or very low-calorie diet for morbid obesity. *Int J Obes* 1988;12: 277-284.
 23. Karason K, Lindroos AK, Stenlof K et al. Relief of cardiorespiratory symptoms and increased physical activity after surgically induced weight loss: results from the Swedish Obese Subjects study. *Arch Intern Med* 2000;160: 1797-1802.
 24. Karlsson J, Sjostrom L, Sullivan M. Swedish obese subjects (SOS): an intervention study of obesity. Two-year follow-up of health-related quality of life (HRQL) and eating behavior after gastric surgery for severe obesity. *Int J Obes* 1998; 22: 113-126.
 25. Fernandez AZ Jr, DeMaria EJ, Tichansky DS et al. Multivariate analysis of risk factors for death following gastric bypass for treatment of morbid obesity. *Ann Surg* 2004; 239: 698-703.
 26. Sjostrom CD, Peltonen M, Wedel H et al. Differentiated long-term effects of intentional weight loss on diabetes and hypertension. *Hypertension*. 2000; 36: 20-25.
 27. Sjostrom CD, Lissner I, Wedel H et al. Reduction in incidence of diabetes, hypertension and lipid disturbances after intentional weight loss induced by bariatric surgery: the SOS Intervention Study. *Obes Res* 1999; 7: 477-484.
 28. Christou NV, Sampalis JS, Liberman M et al. Surgery decreases long-term mortality, morbidity, and health care use in morbidly obese patients. *Ann Surg* 2004; 240: 416-423.
 29. Mun EC, Blackburn GL, Matthews JB. Current status of medical and surgical therapy for obesity. *Gastroenterology* 2001;120: 669-681.
 30. Flum DR, Dellinger E. Impact of gastric bypass on survival: a population-based analysis. *J Am Coll Surg* 2004; 199: 543-551.
 31. American College of Endocrinology (ACE), American Association of Clinical Endocrinologists (AACE). AACE/ACE position statement on the prevention, diagnosis and treatment of obesity. Jacksonville (FL): American Association of Clinical Endocrinologists. *Endocr Pract* 1998; 4: 297-350.
 32. American Society for Bariatric Surgery, Society of American Gastrointestinal Endoscopic Surgeons. Guidelines for laparoscopic and open surgical treatment of morbid obesity. *Obes Surg* 2000; 10: 378-379.
 33. Douketis JD, Feightner JW, Attia J et al, with the Canadian Task Force on Preventive Health Care. Periodic health examination, 1999 update: 1.

- Detection, prevention and treatment of obesity. *CMAJ* 1999; 160: 513-525.
34. International Federation for the Surgery of Obesity. Statement on patient selection for bariatric surgery. *Obes Surg* 1997; 7: 41.
 35. Lauterbach K, Westenhofer J, Wirth A et al. Evidenz-basierte Leitlinie zur Behandlung der Adipositas in Deutschland. Otto Hauser, Köln, 1998.
 36. Msika S. Surgery for morbid obesity: 2. Complications. Results of a Technologic Evaluation by the ANAES. *J Chir (Paris)* 2003;140: 4-21.
 37. National Institute for Clinical Excellence. Guidance on the use of surgery to aid weight reduction for people with morbid obesity (Technology Appraisal No. 46). National Institute for Clinical Excellence, London, 2002.
 38. Apovian CM, Baker C, Ludwig DS et al. Best practice guidelines in pediatric/adolescent weight loss surgery. *Obes Res* 2005;13: 274-282.
 39. Inge TH, Krebs NF, Garcia VF et al. Bariatric surgery for severely overweight adolescents: concerns and recommendations. *Pediatrics* 2004; 114: 217-223.
 40. Sugerma HJ, Sugerma EL, DeMaria EJ et al. Bariatric surgery for severely obese adolescents. *J Gastrointest Surg* 2003; 7: 102-7.
 41. Dolan K, Creighton L, Hopkins G et al. Laparoscopic gastric banding in morbidly obese adolescents. *Obes Surg* 2003; 13: 101-104.
 42. Stanford A, Glascock JM, Eid GM et al. Laparoscopic Roux-en-Y gastric bypass in morbidly obese adolescents. *J Pediatr Surg* 2003; 38: 430-433.
 43. Widhalm K, Dietrich S, Prager G. Adjustable gastric banding surgery in morbidly obese adolescents: Experience with 8 patients. *Int J Obes* 2004; 28: 42S-48S.
 44. Silberhammer GR, Miller K, Kriwanek S et al. Laparoscopic adjustable gastric banding in adolescents: The Austrian experience. *Obes Surg* 2006; 16: 1062-1067.
 45. Capella JF, Capella RF. Bariatric surgery in adolescence: is this the best age to operate? *Obes Surg* 2003; 13: 826-832.
 46. Patterson EJ, Urbach DR, Swanstrom LL. A comparison of diet and exercise therapy versus laparoscopic Roux-en-Y gastric bypass surgery for morbid obesity: a decision analysis model. *J Am Coll Surg* 2003;196: 379-384.
 47. Averbukh Y, Heshka S, El-Shoreya H et al. Depression score predicts weight loss following Roux-en-Y gastric bypass. *Obes Surg* 2003; 13: 833-836.
 48. Ray EC, Nickels MW, Sayeed S et al. Predicting success after gastric bypass: the role of psychosocial and behavioral factors. *Surgery* 2003; 134: 555-564.
 49. Charles SC. Psychiatric evaluation of morbidly obese patients. *Gastroenterol Clin North Am* 1987; 16: 415-432.
 50. Gertler R, Ramsey-Stewart G. Pre-operative psychiatric assessment of patients presenting for gastric bariatric surgery (surgical control of morbid obesity). *Aust N Z J Surg* 1986; 56: 157-161.
 51. Guisado JA, Vaz FJ, Lopez-Ibor JJ et al. Gastric surgery and restraint from food as triggering factors of eating disorders in morbid obesity. *Int J Eat Disord* 2002; 31: 97-100.
 52. Sogg S, Mori DL. The Boston interview for gastric bypass: determining the psychological suitability of surgical candidates. *Obes Surg* 2004; 14: 370-380.
 53. Ferraro DR. Preparing patients for bariatric surgery – the clinical considerations. *Clin Rev* 2004; 14: 57-63.
 54. Naef M, Sadowski C, de Marco D et al. Die vertikale Gastroplastik nach Mason zur Behandlung der morbiden Adipositas: Ergebnisse einer prospektiven klinischen Studie. *Chirurg* 2000; 71: 448-455.
 55. Wiesner W, Schob O, Hauser RS et al. Adjustable laparoscopic gastric banding in patients with morbid obesity: radiographic management, results, and post-operative complications. *Radiology* 2000;216: 389-394.
 56. Schumann R, Jones SB, Ortiz VE et al. Best practice recommendations for anesthetic perioperative care and pain management in weight loss surgery. *Obes Res* 2005; 13: 254-266.
 57. O'Keefe T, Patterson EJ. Evidence supporting routine polysomnography before bariatric surgery. *Obes Surg* 2004; 14: 23-26.
 58. Sugerma HJ, Fairman RP, Baron PL et al. Gastric surgery for respiratory insufficiency of obesity. *Chest* 1986; 90: 81-86.
 59. Sugerma HJ, Fairman RP, Sood RK et al. Long-term effects of gastric surgery for treating respiratory insufficiency of obesity. *Am J Clin Nutr* 1992; 55: 597S-601S.
 60. Miller K, Hell E. Laparoscopic surgical concepts of morbid obesity. *Langenbecks Arch Surg* 2003; 388: 375-384.
 61. Naef M, Sadowski C, de Marco D et al. Die vertikale Gastroplastik nach Mason zur Behandlung der morbiden Adipositas: Ergebnisse einer prospektiven klinischen Studie. *Chirurg* 2000; 71: 448-455.
 62. Gonzalez R, Bowers SP, Venkatesh KR et al.

- Preoperative factors predictive of complicated post-operative management after Roux-en-Y gastric bypass for morbid obesity. *Surg Endosc* 2003; 17: 1900-1914.
63. Frey WC, Pilcher J. Obstructive sleep-related breathing disorders in patients evaluated for bariatric surgery. *Obes Surg* 2003; 13: 676-683.
 64. Sharaf RN, Weinshel EH, Bini EJ et al. Radiologic assessment of the upper gastrointestinal tract: does it play an important preoperative role in bariatric surgery? *Obes Surg* 2004; 14: 313-317.
 65. Jaffin BW, Knoepflmacher P, Greenstein R. High prevalence of asymptomatic esophageal motility disorders among morbidly obese patients. *Obes Surg* 1999; 9: 390-395.
 66. Frigg A, Peterli R, Zynamon A et al. Radiologic and endoscopic evaluation for laparoscopic adjustable gastric banding: preoperative and follow-up. *Obes Surg* 2001; 11: 594-599.
 67. Greenstein RJ, Nissan A, Jaffin B. Esophageal anatomy and function in laparoscopic gastric restrictive bariatric surgery: implications for patient selection. *Obes Surg* 1998; 8: 199-206.
 68. Verset D, Houben JJ, Gay F et al. The place of upper gastrointestinal tract endoscopy before and after vertical banded gastroplasty for morbid obesity. *Dig Dis Sci* 1997; 42: 2333-2337.
 69. Saltzman E, Anderson W, Apovian CM et al. Criteria for patient selection and multidisciplinary evaluation and treatment of the weight loss surgery patient. *Obes Res* 2005; 13: 234-243.
 70. Kelly J, Tarnoff M, Shikora S et al. Best practice recommendations for surgical care in weight loss surgery. *Obes Res* 2005; 13: 227-233.
 71. Brolin RE. Bariatric surgery and long-term control of morbid obesity. *JAMA* 2002; 288: 2793-2796.
 72. Mun EC, Blackburn GL, Matthews JB. Current status of medical and surgical therapy for obesity. *Gastroenterology* 2001; 120: 669-681.
 73. Murr MM, Balsiger BM, Kennedy FP et al. Malabsorptive procedures for severe obesity: comparison of pancreaticobiliary bypass and very very long limb Roux-en-Y gastric bypass. *J Gastrointest Surg* 1999; 3: 607-612.
 74. Scopinaro N, Gianetta E, Adami GF et al. Biliopancreatic diversion for obesity at eighteen years. *Surgery* 1996; 119: 261-268.
 75. Scopinaro N, Marinari GM, Camerini G. Laparoscopic standard biliopancreatic diversion: technique and preliminary results. *Obes Surg* 2002; 12: 362-365.
 76. Howard L, Malone M, Michalek A et al. Gastric bypass and vertical banded gastroplasty – a prospective randomized comparison and 5-year follow-up. *Obes Surg* 1995; 5: 55-60.
 77. van Dielen FM, Soeters PB, de Brauw LM et al. Laparoscopic adjustable gastric banding versus open vertical banded gastroplasty: A prospective randomized trial. *Obes Surg* 2005; 15: 1292-1298.
 78. Brolin RE, Kenler HA, Gorman JH et al. Long-limb gastric bypass in the superobese. A prospective randomized study. *Ann Surg* 1992; 215: 387-395.
 79. Podnos YD, Jimenez JC, Wilson SE et al. Complications after laparoscopic gastric bypass: a review of 3464 cases. *Arch Surg* 2003; 138: 957-961.
 80. Perugini RA, Mason R, Czerniach DR et al. Predictors of complication and suboptimal weight loss after laparoscopic Roux-en-Y gastric bypass: a series of 188 patients. *Arch Surg* 2003; 138: 541-545.
 81. Nguyen NT, Rivers R, Wolfe BM. Factors associated with operative outcomes in laparoscopic gastric bypass. *J Am Coll Surg* 2003; 197: 548-555.
 82. Ren CJ, Weiner M, Allen JW. Favorable early results of gastric banding for morbid obesity: the American experience. *Surg Endosc* 2004; 18: 543-546.
 83. Rubenstein RB. Laparoscopic adjustable gastric banding at a U.S. center with up to 3-year follow-up. *Obes Surg* 2002; 12: 380-384.
 84. O'Brien PE, Dixon JB, Brown W et al. The laparoscopic adjustable gastric band (Lap-Band): a prospective study of medium-term effects on weight, health and quality of life. *Obes Surg* 2002; 12: 652-660.
 85. Spivak H, Favretti F. Avoiding postoperative complications with the LAP-BAND system. *Am J Surg* 2002; 184: 31S-37S.
 86. Belachew M, Belva PH, Desai C. Long-term results of laparoscopic adjustable gastric banding for treatment of morbid obesity. *Obes Surg* 2002; 12: 564-568.
 87. DeMaria EJ, Sugarman HJ. A critical look at laparoscopic adjustable silicone gastric banding for surgical treatment of morbid obesity: does it measure up? *Surg Endosc* 2000; 14: 697-699.
 88. Favretti F, Cadiere GB, Segato G et al. Laparoscopic adjustable silicone gastric banding (Lap-Band): how to avoid complications. *Obes Surg* 1997; 7: 352-358.
 89. Fried M, Miller K, Kormanova K. Literature review of comparative studies of complications with Swedish band and Lap-Band. *Obes Surg* 2004; 14: 256-260.
 90. Fried M, Peskova M, Kasalicky M. Assessment of

- the outcome of laparoscopic nonadjustable gastric banding and stoma adjustable gastric banding: surgeon's and patient's view. *Obes Surg* 1998; 8: 45-48.
91. Hall JC, Watts JM, O'Brien PE et al. Gastric surgery for morbid obesity. The Adelaide Study. *Ann Surg* 1990; 211: 419-427.
 92. Laws HL, Piantadosi S. Superior gastric reduction procedure for morbid obesity: a prospective, randomized trial. *Ann Surg* 1981; 193: 334-340.
 93. Bajardi G, Ricevuto G, Mastrandrea G et al. Surgical treatment of morbid obesity with biliopancreatic diversion and gastric banding: report on an 8-year experience involving 235 cases. *Ann Chir* 2000; 125: 155-162.
 94. Chapman AE, Kiroff G, Game P et al. Laparoscopic adjustable gastric banding in the treatment of obesity: a systematic literature review. *Surgery* 2004; 135: 326-351.
 95. Dolan K, Hatzifotis M, Newbury L et al. A comparison of laparoscopic adjustable gastric banding and biliopancreatic diversion in superobesity. *Obes Surg* 2004; 14: 165-169.
 96. Jones DB, Provost DA, DeMaria EJ et al. Optimal management of the morbidly obese patient. SAGES appropriateness conference statement. *Surg Endosc* 2004; 18: 1029-1037.
 97. American Society for Bariatric Surgery. 2004 ASBS Bariatric Surgery guidelines. www.lapsurgery.com
 98. Society of American Gastrointestinal Endoscopic Surgeons. Guidelines for institutions granting bariatric privileges utilizing laparoscopic techniques. SAGES and the SAGES Bariatric Task Force. *Surg Endosc* 2003; 17: 2037-2040.
 99. Flum DR, Dellinger EP. Impact of gastric bypass-operation on survival: a population-based analysis. *J Am Coll Surg* 2004; 199: 543-551.
 100. Schauer P, Ikramuddin S, Hamad G et al. The learning curve for laparoscopic Roux-en-Y gastric bypass is 100 cases. *Surg Endosc* 2003; 17: 212-215.
 101. Wittgrove AC, Clark GW. Laparoscopic gastric bypass, Roux-en-Y – 500 patients: technique and results with 3-60 months follow-up. *Obes Surg* 2000; 10: 233-239.
 102. Higa KD, Boone KB, Ho T et al. Laparoscopic Roux-en-Y gastric-bypass for morbid obesity: technique and preliminary results of our first 400 patients. *Arch Surg* 2000; 135: 1029-1033.
 103. Courcoulas A, Schuchert M, Gatti G et al. The relationship of surgeon and hospital volume to outcome after gastric bypass surgery in Pennsylvania: a 3-year summary. *Surgery* 2003; 134: 613-623.
 104. Bloomberg RD, Fleishman A, Nalle JE et al. Nutritional deficiencies following bariatric surgery: what have we learned? *Obes Surg* 2005; 15: 145-154.
 105. Deitel M, Shikora SA. The development of the surgical treatment of morbid obesity. *J Am Coll Nutr* 2002; 21: 365-371.
 106. Shen R, Dugay G, Rajaram K et al. Impact of patient follow-up on weight loss after bariatric surgery. *Obes Surg* 2004; 14: 514-519.
 107. Favretti F, O'Brien PE, Dixon JB. Patient management after LAP-BAND placement. *Am J Surg* 2002; 184: 38S-41S.
 108. Busetto L, Pisent C, Segato G et al. The influence of a new timing strategy of band adjustment on the vomiting frequency and the food consumption of obese women operated with laparoscopic adjustable silicone gastric banding (LAP-BAND). *Obes Surg* 1997; 7: 505-512.
 109. Rabkin RA, Rabkin JM, Metcalf B et al. Nutritional markers following duodenal switch for morbid obesity. *Obes Surg* 2004; 14: 84-90.
 110. Ledikwe JH, Smiciklas-Wright H, Mitchell DC et al. Nutritional risk assessment and obesity in rural older adults: a sex difference. *Am J Clin Nutr* 2003; 77: 551-558.
 111. Ledikwe JH, Smiciklas-Wright H, Mitchell DC et al. Dietary patterns of rural older adults are associated with weight and nutritional status. *J Am Geriatr Soc* 2004; 52: 589-595.
 112. MacLean LD, Rhode B, Shizgal HN. Nutrition after vertical banded gastroplasty. *Ann Surg* 1987; 206: 555-563.
 113. Hamoui N, Anthone G, Crookes PF. Calcium metabolism in the morbidly obese. *Obes Surg* 2004; 14: 175-181.
 114. Faintuch J, Matsuda M, Cruz ME et al. Severe protein-calorie malnutrition after bariatric procedures. *Obes Surg* 2004; 14: 175-181.
 115. Baltasar A, Serra C, Perez N et al. Clinical hepatic impairment after the duodenal switch. *Obes Surg* 2004; 14: 77-83.
 116. Boylan LM, Sugerman HJ, Driskell JA. Vitamin E, vitamin B-6, vitamin B-12, and folate status of gastric bypass surgery patients. *J Am Diet Assoc* 1988; 88: 579-585.
 117. Cannizzo F Jr, Kral JG. Obesity surgery: a model of programmed undernutrition. *Curr Opin Clin Nutr Metab Care* 1998; 1: 363-368.
 118. Hamoui N, Kim K, Anthone G et al. The significance of elevated levels of parathyroid hormone in patients with morbid obesity before and after

- bariatric surgery. *Arch Surg* 2003; 138: 891-897.
119. Skroubis G, Sakellaropoulos G, Pougouras K et al. Comparison of nutritional deficiencies after Roux-en-Y gastric bypass and after biliopancreatic diversion with Roux-en-Y gastric bypass. *Obes Surg* 2002; 12: 551-558.
 120. Slater GH, Ren CJ, Siegel N et al. Serum fat-soluble vitamin deficiency and abnormal calcium metabolism after malabsorptive bariatric surgery. *J Gastrointest Surg* 2004; 8: 48-55.
 121. Halverson JD. Micronutrient deficiencies after gastric bypass for morbid obesity. *Am Surg* 1986; 52: 594-598.
 122. Avinoah E, Ovnat A, Charuzi I. Nutritional status seven years after Roux-en-Y gastric bypass surgery. *Surgery* 1992; 111: 137-142.
 123. Brolin RE, Gorman RC, Milgrim LM et al. Multivitamin prophylaxis in prevention of post-gastric bypass vitamin and mineral deficiencies. *Int J Obes* 1991; 15: 661-667.
 124. Rhode BM, Arseneau P, Cooper BA et al. Vitamin B-12 deficiency after gastric surgery for obesity. *Am J Clin Nutr* 1996; 63: 103-109.
 125. Schilling RF, Gohdes PN, Hardie GH. Vitamin B12 deficiency after gastric bypass surgery for obesity. *Ann Intern Med* 1984; 101: 501-502.
 126. Simon SR, Zemel R, Betancourt S et al. Hematologic complications of gastric bypass for morbid obesity. *South Med J* 1989; 82: 1108-1110.
 127. Brolin RE, Gorman JH, Gorman RC et al. Are vitamin B12 and folate deficiency clinically important after Roux-en-Y gastric bypass? *J Gastrointest Surg* 1998; 2: 436-442.
 128. Halverson JD. Metabolic risk of obesity surgery and long term follow-up. *Am J Clin Nutr* 1992; 55: 602S-605S.
 129. Goode LR, Brolin RE, Chowdhury HA et al. Bone and gastric bypass surgery: effects of dietary calcium and vitamin D. *Obes Res* 2004; 12: 40-47.
 130. Coates PS, Fernstrom JD, Fernstrom MH et al. Gastric bypass surgery for morbid obesity leads to an increase in bone turnover and a decrease in bone mass. *J Clin Endocrinol Metab* 2004; 89: 1061-1065.
 131. Shaker JL, Norton AJ, Woods MF et al. Secondary hyperparathyroidism and osteopenia in women following gastric exclusion surgery for obesity. *Osteoporos Int* 1991; 1: 177-181.
 132. Abu-Abeid S, Keidar A, Gavert N et al. The clinical spectrum of band erosion following laparoscopic adjustable silicone gastric banding for morbid obesity. *Surg Endosc* 2003; 17: 861-863.
 133. Jones KB Jr. Revisional bariatric surgery - safe and effective. *Obes Surg* 2001; 11: 183-189.
 134. Weber M, Muller MK, Michel JM et al. Laparoscopic Roux-en-Y gastric bypass, but not rebanding, should be proposed as rescue procedure for patients with failed laparoscopic gastric banding. *Ann Surg* 2003; 238: 827-834.
 135. Dolan K, Fielding G. Biliopancreatic diversion following failure of laparoscopic adjustable gastric banding. *Surg Endosc* 2004; 18: 60-63.
 136. Chevallier JM, Zinzindohoue F, Douard R et al. Complications after laparoscopic adjustable gastric banding for morbid obesity: experience with 1,000 patients over 7 years. *Obes Surg* 2004; 14: 407-414.
 137. Iovino P, Angrisani L, Tremolaterra F et al. Abnormal esophageal acid exposure is common in morbidly obese patients and improves after a successful Lap-band system implantation. *Surg Endosc* 2002; 16: 1631-1635.
 138. Niville E, Dams A. Late pouch dilation after laparoscopic adjustable gastric and esophagogastric banding: incidence, treatment, and outcome. *Obes Surg* 1999; 9: 381-384.
 139. Sanyal AJ, Sugarman HJ, Kellum JM et al. Stomal complications of gastric bypass: incidence and outcome of therapy. *Am J Gastroenterol* 1992; 87: 1165-1169.
 140. Schwartz ML, Drew RL, Roiger RW et al. Stenosis of the gastroenterostomy after laparoscopic gastric bypass. *Obes Surg* 2004; 14: 484-491.
 141. Barba CA, Butensky MS, Lorenzo M et al. Endoscopic dilation of gastroesophageal anastomosis stricture after gastric bypass. *Surg Endosc* 2003; 17: 416-420.
 142. Schauer PR, Ikramuddin S, Gourash W et al. Outcomes after laparoscopic Roux-en-Y gastric bypass for morbid obesity. *Ann Surg* 2000; 232: 515-529.
 143. Spaulding L. Treatment of dilated gastrojejunostomy with sclerotherapy. *Obes Surg* 2003; 13: 254-257.
 144. Anthone GJ, Lord RV, DeMeester TR et al. The duodenal switch operation for the treatment of morbid obesity. *Ann Surg* 2003; 238: 618-628.
 145. Bloomberg RD, Urbach DR. Laparoscopic Roux-en-Y gastric bypass for severe gastroesophageal reflux after vertical banded gastroplasty. *Obes Surg* 2002; 12: 408-441.