

Interdisciplinary European Guidelines on Surgery of Severe Obesity*

Martin Fried^a Vojtěch Hainer^b Arnaud Basdevant^c Henry Buchwald^d Mervyn Deitel^e
Nicholas Finer^f Jan Willem M. Greve^g Fritz Horber^h Elisabeth Mathus-Vliegenⁱ
Nicola Scopinaro^j Rudolf Steffen^k Constantine Tsigos^l Rudolf Weiner^m Kurt Widhalmⁿ

^a Clinical Center for Minimally Invasive and Bariatric Surgery, 1st Medical Faculty, Charles University, Prague, Czech Republic

^b Institute of Endocrinology, 1st and 3rd Medical Faculty, Charles University, Prague, Czech Republic

^c INSERM, U755 Nutriomique, University of Paris and AP-HP, Hôtel-Dieu Hospital, Paris, France

^d Department of Surgery, University of Minnesota, MN, USA

^e CRCSC, FICS, FACN, OBESITY SURGERY, Toronto, Canada

^f Wellcome Clinical Research Facility, Addenbrooke's Hospital, University of Cambridge School for Clinical Medicine, UK

^g Department of Surgery University Hospital Maastricht, The Netherlands

^h Klinik Lindberg AG, Winterthur, Switzerland

ⁱ Academic Medical Centre, Department of Gastroenterology and Hepatology, University of Amsterdam, The Netherlands

^j University of Genoa, San Martino University Hospital, Genoa, Italy

^k Beau-Site Clinic Berne, Hirslanden Group, Switzerland

^l Department of Endocrinology, Metabolism and Diabetes Unit, Evgenidion Hospital, University of Athens Medical School, Athens, Greece

^m Sachsenhausen Hospital and Center for Minimally Invasive Surgery, Johan Wolfgang Goethe University, Frankfurt/M., Germany

ⁿ Department of Pediatrics, Nutrition and Metabolism, Medical University of Vienna, Vienna, Austria

Key Words

European guidelines · Surgery · BSCG · Interdisciplinary

Summary

In 2005, for the first time in European history, an extraordinary expert panel named BSCG (Bariatric Scientific Collaborative Group), was appointed through joint effort of the major European scientific societies which are active in the field of obesity management. Societies that constituted this panel were: IFSO – International Federation for the Surgery of Obesity, IFSO-EC – International Federation for the Surgery of Obesity – European Chapter, EASO – European Association for Study of Obesity, ECOG – European Childhood Obesity Group, together with the IOTF (International Obesity Task Force) which was represented during the completion process by its representative. The BSCG was composed not only of the top officers representing the respective scientific societies (four acting presidents, two past presidents, one honorary president, two executive directors), but was balanced with the presence of many other key opinion leaders in the field of obesity. The BSCG composition allowed the coverage of key disciplines in comprehensive obesity management, as well as reflecting European geographical and ethnic diversity. This joint BSCG expert panel convened several meetings which were entirely focused on guidelines creation, during the past 2 years. There was a specific effort to develop clinical guidelines, which will reflect current knowledge, expertise and evidence based data on morbid obesity treatment.

First published in *Obesity Surgery* 2007;17(2):260–270 – a publication of Springer Science+Business Media, LLC, New York/Heidelberg.

Introduction

The prevalence of obesity is increasing world-wide at an alarming rate and represents a global epidemic in both developed and developing countries [1].

According to the data published by the International Obesity Task Force (IOTF), at least 1.1 billion adults are overweight, and 312 million of them are obese. Prevalence of obesity (body mass index (BMI) ≥ 30 kg/m²) in Europe is reported in the range 10–20% in men and 15–25% in women, and almost a half of the European population is overweight or obese (BMI ≥ 25 kg/m²) [2].

Overweight and obesity are associated with increased risks of type 2 diabetes, hypertension, cardiovascular disease, dyslipidaemia, arthritis, non-alcoholic steatohepatitis, gall-bladder disease, sleep apnoea syndrome and several cancers [3].

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

Increasing body weight impairs quality of life 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 (BMI ≥ 40 kg/m²) in the US in 2002 was 1.8%; 60% of morbidly obese people were women, and 63% were in the ages range 18–49 years [7].

Premature mortality increases with increasing BMI. Relative risk of death at the age of 50 years among men and women with BMI ≥ 40 kg/m² who had 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 disease, but also the socioeconomic burden. Annual direct health-care costs of the severely obese (BMI ≥ 35 kg/m²) are three times higher than those of normal weight subjects [10].

Bariatric surgery has proved to be the most effective mode of treatment of the morbidly obese patients [11]. Recent long-term studies show that there is a substantial reduction of mortality in bariatric surgery patients, as well as decreased risk of developing new health-related co-morbidities, and health-care utilization and 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 through the interdisciplinary effort of key opinion leaders from international medical and surgical societies (International Federation for the Surgery of Obesity (IFSO), International Federation for the Surgery of Obesity – European Chapter (IFSO-EC), European Association for Study of Obesity (EASO), IOTF, European Childhood Obesity Group (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 evidence level data to support conclusions of this panel of experts were systematically obtained from 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 was also retrieved from the 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 et al.'s 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 '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 RCT, 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 in age groups from 18 to 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 (such as metabolic disorders, cardio-respiratory disease, severe joint disease, obesity-related severe psychological problems) etc. EL A, B, D [19–37].
3. BMI criterion may be the current BMI or a documented previous BMI of this severity. Note that
 - a) Weight loss as a result of intensified treatment before surgery (patients who 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 programme but started to gain weight again.

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 [20, 37].

Patients must have shown their compliance with medical appointments.

Bariatric Surgery in (Children)/Adolescents

Indication for bariatric surgery in adolescents and children could be considered in centres with extensive experience of such treatment in adults and who are able to offer a true multidisciplinary approach, which involves paediatric skills relating to surgery, dietetics and psychological management.

In adolescents with severe obesity, bariatric surgery can be considered if the patient

1. has a BMI > 40 kg/m² (or 99.5 ° percentile for respective age) and at least one co-morbidity,
2. has followed at least 6 months of organized weight reducing attempts in a specialized centre,
3. shows skeletal and developmental maturity,
4. is capable to commit to comprehensive medical and psychological evaluation before and after surgery,
5. is willing to participate in a postoperative multidisciplinary treatment programme,
6. can access surgery in a unit with specialist paediatric support (nursing, anaesthesia, psychology, postoperative care). (EL C, D [38–45])

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

Bariatric Surgery in Those Aged above 60

Indication for bariatric surgery should be considered individually.

The proof of a favourable risk benefit 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 quality of life, even though surgery is unlikely to increase lifespan [46].

Contraindications Specific for Bariatric Surgery

1. Absence of a period of identifiable medical management.
2. 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.

Patient Preoperative Evaluation

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.

(EL B,C, D [16, 20, 47–54])

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

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 programmes,
- ensuring that the patient is fully informed on the benefits, consequences and risks of the surgical options and the necessity of lifelong 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 behaviour modification of life style and of follow-up.

In addition to the routine preoperative assessment as for any other major abdominal surgery, the patient may undergo further assessment for (depending on the planned bariatric procedure and 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 [16, 55–69])

Surgical Techniques Overview

Definition

- Food limitation operations
 - Restrictive procedures
 - Vertical-banded gastroplasty (VBG)
 - Gastric sleeve resection
 - Gastric banding
 - Adjustable gastric banding (AGB)
 - Non-adjustable gastric bypass (GBP) proximal
 - GBP long/limb.
- Operations limiting absorption of nutrients
 - 'Energy' absorption limiting operations
 - Biliopancreatic diversion (BPD)

- Combined operations
 - Biliopancreatic diversion with duodenal switch (BPD DS)
 - Distal gastric bypass (common limb 100 cm or less).

A laparoscopic technique should be considered as the first treatment choice in bariatric surgery, unless specific contra-indications for laparoscopic operation are present.

Assigning a Patient to a Particular Bariatric Procedure

At this moment, there is insufficient evidence-based data to suggest how to assign a patient to any particular bariatric procedure.

Among others preoperative factors that could influence the choice of the type of operation:

- BMI,
- age,
- gender,
- body fat distribution,
- type 2 diabetes mellitus,
- dyslipidaemia,
- binge eating disorders (BED),
- low IQ,
- significant hiatal hernia,
- GERD,
- patient's expectations/realistic goals.

The expected average weight loss and weight maintenance is increasing 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 [17, 70–95]).

The procedures should be performed at interdisciplinary obesity management centres with appropriately trained staff and adequate equipment (see above).

In all situations, the bariatric surgeon's experience is a key issue. It is not advisable to practise 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 [20, 96–103]).

As a result of successful bariatric treatment, further treatment (such as plastic/reconstructive surgery) might be required.

Follow-Up

Morbid obesity is a lifelong disease. The treating physician and 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 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:

- the possible deficiencies, such as vitamin, protein, and other micronutrients,
- adjustments of medical treatment of the obesity-related morbidities such as diabetes, and hypertension.

All patients after bariatric procedures require regular lifelong qualified surveillance.

Patients must have access to 24-hour emergency service provided by the operating centre.

The patient takes lifelong 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 exact type of the received implant (if applicable) together with description of possible serious adverse effect.

- AGB
 - Follow-up during the first year should at least be every 3 months, starting 1 month postoperatively until a clinically satisfactory rate of weight loss is achieved, if necessary with repeated bandfills. Thereafter follow-up should be at intervals of no more than 1 year.
 - 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 weight loss and the type of the implant,
 - first inflation according to the type of the band,
 - as a medical/clinical decision,
 - by trained medical or paramedical staff with adequate experience (such as surgeon, medical physician, nurse practitioner, dedicated radiologist).
 - Supplement of vitamins and micronutrients should compensate for their possible reduced intake.
- VBG, non-adjustable gastric banding, and other pure gastric restriction operations
 - Similar recommendations as for AGB, except there will be no band adjustments.

- GBP
 - Checkup after 1 month, minimal follow-up every 3 months for the 1st year, every 6 months for the 2nd year and annually thereafter.
 - Vitamin and micronutrient supplements (oral) should routinely be prescribed to compensate for their possible reduced intake and absorption.
 - However, in addition, laboratory tests to evaluate the metabolic and nutritional status should also be carried out annually to include
 - fasting glucose (+HbA1c in diabetics), liver function test, renal function, vitamin B₁₂, ²⁵(OH) vitamin D₃, ferritin, Ca, parathormone, albumin, Hb, Mg²⁺, Ca²⁺, zinc checks.
 - As a result of these test, it may be necessary to correct deficits by parenteral administration of vitamins and micronutrients.
 - In case of secondary lactose intolerance, supplement with oral lactase.
 - In case of early dumping syndrome, hydration before meals is advised and the use of corn starch supplements considered.
 - In case of late dumping syndrome hypoglycaemia should be considered and the patient advised accordingly.

Minimal Requirements and Recommendations for Follow-Up after Operations Limiting Absorption of Nutrients

- BPD
 - Checkup after 1 month, followed by minimal follow-up every 3 months after the operation in the 1st postoperative year, every 6 months in the 2nd year, and annually thereafter.
 - Lab tests are necessary to evaluate the evolution 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, parathormone, bone alkaline phosphatase, ferritin, Ca, albumin, transferrin, creatinine, prothrombin time (PPT),
 - urine examination.

- Lifelong daily vitamin and micronutrient supplementation (vitamins should be administered in a water-soluble form).
- Vitamin A, D, E and K.
- Calcium supplementation (preferably in Ca citrate, recommended total intake 2 g/day).
- Minimum advised protein intake of approximately 90 g/day.
- Supplement of vitamins and micronutrients should compensate for their possible reduced intake and according to lab values
 - in a preventive regimen the supplementation can be administered orally,
 - for correction of deficits, the supplementation should be administered parenterally, except for Ca.
- Proton pump inhibitors/histamine 2 receptor antagonists for the entire first postoperative year.

In case of excessive bloating, flatulence and/or foul-smelling stools, the recommended treatments are oral neomycin or metronidazole or pancreatic enzymes (EL A, B, C, D [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 [132–145]).

Conclusion

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

References

- 1 Obesity: Preventing and Managing the Global Epidemic. Report of a WHO Consultation. Geneva, WHO Technical Report Series, 894, 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, Stampfer MJ, Willett WC: 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, Manson JE: Weight gain as a risk factor for clinical diabetes mellitus in women. *Ann Int Med* 1995;122:481–486.
- 6 Banegas JR, Polec-Garcia E, Gutierrez-Fisac JL, Guallar-Castillon P, Rodriguez-Artalejo F: 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, Smalley W, Richards WO, Wright JK, et al: National variations in morbid obesity and bariatric surgery use. *J Am Coll Surg* 2005;201:77–84.
- 8 Adams KF, Schatzkin A, Harris TB, Kipnis V, Mouw T, Ballard-Barbash R, et al: Overweight, obesity, and mortality in a large prospective cohort of persons 50 to 71 years old. *N Engl J Med* 2006;355:763–768.
- 9 Drenick EJ, Bale GS, Seltzer F, Johnson DG: 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) (in German). *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, Jensen MD, Pories W, Fahrbach K, et al: Bariatric surgery: a systematic review and meta-analysis. *JAMA* 2004;292:1724–1737.
- 14 Canello R, Henegar C, Viguier N, Taleb S, Poitou CH, Rouault CH, 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 Lehman Center Weight Loss Surgery Expert Panel: Commonwealth of Massachusetts Betsy Lehman Center for Patient Safety and Medical Error Reduction Expert Panel on weight loss surgery: executive report. *Obes Res* 2005;13:205–305.
- 16 Sauerland S, Angrisani L, Belachew M, Chevallier JM, Favretti F, Finer N, et al: Obesity surgery. Evidence based guidelines of the EAES. *Surg Endosc* 2005;19:200–221.
- 17 Maggard MA, Shugarman ML, Suttrop M, Maglione M, Sugerma HJ, Livingston EH, et al: Meta-analysis: surgical treatment of obesity. *Ann Int Med* 2005;142:547–559.
- 18 Laville M, Romon M, Chavrier G, Guy-Grand B, Krempf M, Chevallier JM, et al: Recommendations regarding obesity surgery. *Obes Surg* 2005;15:1476–1480.
- 19 NIH Conference: Gastrointestinal surgery for severe obesity. Consensus development conference panel. *Ann Intern Med* 1991;115:956–961.
- 20 Ridley N: Expert panel on weight loss surgery – executive report. *Obes Res* 2005;13:206–226.
- 21 Andersen T, Backer OG, Stokholm KH, Quaade F: 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, Quaade F: 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, Sjostrom L: 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 Relat Metab Disord* 1998;22:113–126.
- 25 Fernandez AZ Jr, Demaria EJ, Tichansky DS, Kellum JM, Wolfe LG, Meador J: 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, Sjostrom L: Differentiated long-term effects of intentional weight loss on diabetes and hypertension. *Hypertension* 2000;36:20–25.
- 27 Sjostrom CD, Lissner I, Wedel H, Sjostrom L: 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, Look D, Auger S, McLean A, 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, American Association of Clinical Endocrinologists, 1998.
- 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, Feldman WF, 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, Hauner H: Evidenz-basierte Leitlinie zur Behandlung der Adipositas in Deutschland. Köln, Otto Hauser, 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: 2002 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, Hoppin AG, Hsu C, Lenders C, et al: Best practice guidelines in pediatric/adolescent weight loss surgery. *Obes Res* 2005;13:274–282.
- 39 Inge TH, Krebs NF, Garcia VF, Skelton JA, Guice KS, Strauss RS, et al: Bariatric surgery for severely overweight adolescents: concerns and recommendations. *Pediatrics* 2004;114:217–223.
- 40 Sugerma HJ, Sugerma EL, DeMaria EJ, Kellum JM, Kennedy C, Mowery Y, et al: Bariatric surgery for severely obese adolescents. *J Gastrointest Surg* 2003;7:102–107.
- 41 Dolan K, Creighton L, Hopkins G, Fielding G: Laparoscopic gastric banding in morbidly obese adolescents. *Obes Surg* 2003;13:101–104.
- 42 Stanford A, Glascock JM, Eid GM, Kane T, Ford HR, Ikramuddin S, 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 Relat Metab Disord* 2004;28(suppl 3):42S–48S.
- 44 Silberhumer GR, Miller K, Kriwanek S, Widhalm K, Pump A, Prager G: 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, Flancbaum L, Geliebter A, Kamel S, 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, Sax HC: 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, Lopez-Ibor MI, del Rio J, Rubio MA: 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, Sabbioni M, Balsiger B, Laederach K, et al: Die vertikale Gastroplastik nach Mason zur Behandlung der morbid Adipositas: Ergebnisse einer prospektiven klinischen Studie. *Chirurg* 2000;71:448–455.

- 55 Wiesner W, Schob O, Hauser RS, Hauser M: Adjustable laparoscopic gastric banding in patients with morbid obesity: radiographic management, results, and postoperative complications. *Radiology* 2000;216:389-394.
- 56 Schumann R, Jones SB, Ortiz VE, Connor K, Pulai I, Ozawa ET, 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 Sugerman HJ, Fairman RP, Baron PL, Kwentus JA: Gastric surgery for respiratory insufficiency of obesity. *Chest* 1986;90:81-86.
- 59 Sugerman HJ, Fairman RP, Sood RK, Engle K, Wolfe L, Kellum JM: Long-term effects of gastric surgery for treating respiratory insufficiency of obesity. *Am J Clin Nutr* 1992;55(suppl 2):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, Sabbioni M, Balsiger YW, Laederach K, et al: Die vertikale Gastroplastik nach Mason zur Behandlung der morbid Adipositas: Ergebnisse einer prospektiven klinischen Studie. *Chirurg* 2000;71:448-455.
- 62 Gonzalez R, Bowers SP, Venkatesh KR, Lin E, Smith CD: Preoperative factors predictive of complicated postoperative 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, Rosenberg J, Ren CJ: 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, Lang C, Tondelli P: Radiologic and endoscopic evaluation for laparoscopic adjustable gastric banding: preoperative and follow-up. *Obes Surg* 2001;11:594-599.
- 67 Greenstein RJ, Nissam 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, Elcherth J, Bourgeois V, Van Gossum A: 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, Hannah B, Alison C, Diana C-D, 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, Thayer B, Jones DB, Forse RA, 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, Mai JL, Sarr MG: Malabsorptive procedures for severe obesity: comparison of pancreaticobiliary bypass and very long limb Roux-en-Y gastric bypass. *J Gastrointest Surg* 1999;3:607-612.
- 74 Scopinaro N, Gianetta E, Adami GF, Friedman D, Traverso E, Marinari GM, 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, Carter J, Alger S, Van Woert J: 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, Grewe JW: 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, Cody RP: Long-limb gastric bypass in the superobese. A prospective randomized study. *Ann Surg* 1992;215:387-395.
- 79 Podnos YD, Jimenez JC, Wilson SE, Stevens CM, Nguyen NT: Complications after laparoscopic gastric bypass: a review of 3464 cases. *Arch Surg* 2003;138:957-961.
- 80 Perugini RA, Mason R, Czerniach DR, Novitsky YW, Baker S, Litwin DEM, 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 US center with up to 3-year follow-up. *Obes Surg* 2002;12:380-384.
- 84 O'Brien PE, Dixon JB, Brown W, Schachter LM, Chapman L, Burn AJ, 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(suppl 2):31S-37S.
- 86 Belachew M, Belva PH, Desaise C: Long-term results of laparoscopic adjustable gastric banding for treatment of morbid obesity. *Obes Surg* 2002;12:564-568.
- 87 DeMaria EJ, Sugerman 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, Himpens J, Busetto L, De Marchi F, 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, Dunstan RE, Walsh JF, Slavotinek AH, 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, Branca M, Rinaudo G, Cali F, 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, Foster B, O'Brien PE, Ham J, 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, Fielding G: A comparison of laparoscopic adjustable gastric banding and biliopancreatic diversion in super-obesity. *Obes Surg* 2004;14:165-169.
- 96 Jones DB, Provost DA, DeMaria EJ, Smith CD, Morgenstern L, Schirmer B: Optimal management of the morbidly obese patient SAGES appropriateness conference statement. *Surg Endosc* 2004;18:1029-1037.
- 97 American Society for Bariatric Surgery: Bariatric surgery: ASBS guidelines. www.lapsurgery.com 2004.
- 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, Gourash W: 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, Davies OG: 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, Luketich J: 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 Miller K, Hell E: Laparoscopic surgical concepts of morbid obesity. *Langenbecks Arch Surg* 2003;388:375-384.
- 105 Laville M, Romon M, Chavrier G, Guy-Grand B, Krempf M, Chevallier JM, et al: Recommendations regarding obesity surgery. *Obes Surg* 2005;15:1476-1480.
- 106 Shen R, Dugay G, Rajaram K, Cabrera I, Siegel N, Ren CJ: 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(suppl 2):38S-41S.
- 108 Busetto L, Pisent C, Segato G, De Marchi F, Favretti F, Lise M, 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, Lazo M, Rossi M, Lehman-Becker LB: Nutritional markers following duodenal switch for morbid obesity. *Obes Surg* 2004;14:84-90.
- 110 Ledikwe JH, Smicklas-Wright H, Mitchell DC, Jensen GL, Friedmann JM, Still CD: Nutritional risk assessment and obesity in rural older adults: a sex difference. *Am J Clin Nutr* 2003;77:551-558.
- 111 Ledikwe JH, Smicklas-Wright H, Mitchell DC, Miller CK, Jensen GL: 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;14:9-12.
- 114 Faintuch J, Matsuda M, Cruz ME, Silva MM, Teivelis MP, Garrido AB Jr, et al: Severe protein-calorie malnutrition after bariatric procedures. *Obes Surg* 2004;14:175-181.
- 115 Baltasar A, Serra C, Perez N, Bou R, Bengochea M: Clinical hepatic impairment after the duodenal switch. *Obes Surg* 2004;14:77-83.
- 116 Boylan LM, Sugeran 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, Crookes PF: 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, Mead N, Nikiforidis G, Kalfarentzos F: 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, Williams T, Barr D, Wolfe B, 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, Kenler HA: Multivitamin prophylaxis in prevention of post-gastric bypass vitamin and mineral deficiencies. *Int J Obes Relat Metab Disord* 1991;15:661-667.
- 124 Rhode BM, Arseneau P, Cooper BA, Katz M, Gilfix BM, MacLean LD: 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, Zidar BL: Hematologic complications of gastric bypass for morbid obesity. *South Med J* 1989;82:1108-1110.
- 127 Brolin RE, Gorman JH, Gorman RC, Petschenik AJ, Bradley LJ, Kenler HA, 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(suppl 2):602S-605S.
- 129 Goode LR, Brolin RE, Chowdhury HA, Shapses SA: 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, Schauer PR, Greenspan SL: 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, Fallon MD, Findling JW: 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, Blanc A, Szold A: 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, Belal R, Horber F, Hauser R, 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: Bilio pancreatic diversion following failure of laparoscopic adjustable gastric banding. *Surg Endosc* 2004;18:60-63.
- 136 Chevallier JM, Zinzindohoue F, Douard R, Blanche JP, Berta JL, Altman JJ, 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, Nirchio E, Ciannella M, Borrelli V, 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, Sugeran HJ, Kellum JM, Engle KM, Wolfe L: Stomal complications of gastric bypass: incidence and outcome of therapy. *Am J Gastroenterol* 1992;87:165-169.
- 140 Schwartz ML, Drew RL, Roiger RW, Ketover SR, Chazin-Caldie M: Stenosis of the gastroenterostomy after laparoscopic gastric bypass. *Obes Surg* 2004;14:484-491.
- 141 Barba CA, Butensky MS, Lorenzo M, Newman R: Endoscopic dilation of gastroesophageal anastomosis stricture after gastric bypass. *Surg Endosc* 2003;17:416-420.
- 142 Schauer PR, Ikramuddin S, Gourash W, Ramanathan R, Luketich J: 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, Crookes PF: 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.