Indications for Surgery for Obesity and Weight-Related Diseases: Position Statements from the International Federation for the Surgery of Obesity and Metabolic Disorders (IFSO)

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ANNOUNCEMENT

Indications for Surgery for Obesity and Weight-Related Diseases: Position Statements from the International Federation for the Surgery of Obesity and Metabolic Disorders (IFSO)

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Final Recommendations

Obesity is a chronic disease that has already reached pandemic proportions and is becoming one of the leading causes of death and disability worldwide. A comprehensive, sustainable, and proactive strategy to deal with the challenges posed by the obesity epidemic is urgently needed. Weight loss induced by surgery has proven to be highly efficacious in treating obesity and its comorbidities.

Body mass index (BMI) and anthropometric measures, although useful, have important limitations when applied to individuals as indications for surgery for obesity and weight-related diseases. Any indication for surgery has to consider the metabolic comorbidities, particularly type 2 diabetes mellitus (T2DM), physical symptoms, psychological/psychiatric symptoms, and the limitations of functional status. For these reasons, the words "bariatric," "obesity," or "metabolic" surgery should be replaced by the words "surgery for obesity and weight-related diseases" which better explains the fact that these surgeries are able to dramatically improve and even cure obesity and weight-related conditions.

After a careful review of the available data concerning the safety and efficacy of surgery for obesity and weight-related diseases and its effectiveness in treating obesity and related comorbidities, this panel reached a consensus on these recommendations:

1. Surgery for obesity and weight-related diseases may be an effective therapeutic option for the management of T2DM in patients with obesity demonstrating good results in terms of glycemic control, glycosylated hemoglobin, and diabetes medications. Furthermore, surgical weight loss treatment improves components of the metabolic syndrome (MSy). This applies to patients with class I obesity (BMI >30 kg/m2) as well as patients with obesity of higher classes. Surgery for obesity and weight-related diseases reduces cardiovascular disease risk in terms of atherosclerosis, myocardial infarction, stroke, and death.
2. Surgical treatment of obesity may result in resolution/improvement of pulmonary diseases such as obstructive sleep apnea syndrome (OSAS) and asthma.
3. Weight loss induced by surgery may reduce the disabilities derived from joint disease.
4. Surgical operations for obesity and weight-related diseases, particularly Roux-en-Y gastric bypass (RYGB), may result in improvement and even cure of gastroesophageal reflux disease (GERD).
5. Non-alcoholic fatty liver disease (NAFLD), a condition associated with obesity that may progress to end-stage liver disease, may be improved after surgery for obesity.
6. Mental health is a burden to candidates for surgery for obesity and weight-related diseases. Surgery is not

contraindicated for patients with mood and anxiety disorders, binge eating disorder (BED), and night eating syndrome (NES) provided the patients received appropriate mental health treatment. On the contrary, surgery is a contraindication in cases of severe and untreated bipolar disorders, in cases of unstable schizophrenia and psychosis, untreated bulimia nervosa, and intractable substance and alcohol abuse.

7. Secondary obesity caused by endocrinopathies that are inadequately treated medically represents a contraindication to surgery for obesity and weight-related diseases.
8. Weight loss, induced or not by surgery, reduces the risks of gastrointestinal, genito-urinary, reproductive, and hematopoietic malignancies.
9. Weight loss, induced or not by surgery, is recommended for patients with idiopathic intracranial hypertension (IIH) or pseudotumor cerebri.
10. Surgically induced weight loss improves renal function and urinary incontinence in obese patients. Moreover, surgery for obesity could be considered as a bridge to renal transplantation. Finally, surgery is not contraindicated in patients with obesity suffering from chronic renal failure requiring dialysis.
11. Substantial weight loss following surgery for obesity and weight-related diseases may lead to bone mass loss and subsequently increases the risk of fractures. Strategies to limit lean body mass loss should be emphasized.
12. Surgery for obesity and weight-related diseases improves quality of life proportionally to the amount of weight lost. Moreover, surgery enables patients to increase their participation in physical exercise training programs, reduces absenteeism from work, sick leave, and pension for disability.
13. Surgery for obesity and weight-related diseases is effective for subjects under 18 years of age suffering from morbid obesity provided participation in a multidisciplinary evaluation including the patient's pediatrician, parents' cooperation and informed consent. Weight loss surgery is also effective in patients with obesity who are over the age of 60 years but has a higher rate of perioperative complications.
14. Surgery for obesity and weight-related diseases is effective in patients with class I obesity accompanied by comorbidity.

Preamble

Obesity as a chronic disease that has already reached pandemic proportions and is becoming one of the leading causes of death and disability worldwide. Approximately 65 % of the world's population inhabit countries where overweight and obesity kill more people than starvation. It is important to note that severe obesity is a rapidly growing segment of the obesity epidemic in which the detrimental effects are particularly evident and harsh. Importantly, obesity preferentially affects the socially disadvantaged members of the population, and this group has experienced the most rapid increase in obesity prevalence. As a harbinger of a multitude of disabling and fatal diseases, obesity represents one of the most challenging public health concerns of the twenty-first century.

Obesity is a progressive disease, impacting severely on individuals and society alike, and is widely acknowledged as the cause of many other disease states, including most noncommunicable diseases (NCDs). Obesity plays a central role in the development of a number of risk factors and chronic diseases such as hypertension, dyslipidemia, and T2DM inducing cardiovascular morbidity and mortality. Surgery is presently the most effective treatment and the only long-lasting option for this population. The prevention of this disease should be a top public health priority, with increased commitment for concerted, coordinated, and specific actions. A comprehensive, sustainable, and proactive strategy to deal with the challenges posed by the obesity epidemic is urgently needed. For individuals suffering from obesity and weight-related diseases, surgical and endoscopic options should be considered and offered. Surgery for obesity and weight-related diseases has proven to be highly efficacious in treating obesity and its comorbidities. Currently, surgery for obesity and weight-related diseases resolves over 75 % of morbid obesity and super obesity and is equally active on the weight-related comorbidities and complications. Ongoing research is unlocking the mechanisms of action of these procedures in terms of the metabolic parameters they influence and the hormonal and inflammatory processes they alter. Then, based on sound insights and experimental data, we may be able to modify them or even develop more efficacious or safer procedures in the future.

The indication for surgery should not be based solely on BMI. In general, a shift in the paradigm should occur focusing more on the treatment of the diseases and disability related to, and caused by, obesity rather than simply on body weight.

Surgery for obesity and weight-related diseases must now play an important role in reducing morbidity and mortality of populations worldwide. The International Federation for the Surgery of Obesity and Metabolic Disorders (IFSO) is committed to provide the leadership, guidance, and support to national scientific societies and governments, as part of its mission of facilitating and engaging in actions that promote that surgery is an effective and safe treatment of obesity and weight-related diseaes. IFSO also supports all activities of other federations and societies worldwide to reduce the burden of unhealthy excess weight worldwide through prevention and management. However, a wider effort is still needed. The leadership of IFSO has concluded that the words "bariatric," "obesity," and "metabolic" surgery should be replaced by the

words "surgery for obesity and weight-related diseases" which better describe the fact that this surgery is able to dramatically improve and even "cure" obesity and weight-related conditions.

Chapter 1: "Surgery for Obesity and Weight-Related Diseases"

The archaeologic epochs of surgery can be viewed as the layered evolution of broad disciplines. The latest epoch of surgical development is metabolic surgery, which was defined in 1978 as, "the operative manipulation of a normal organ or organ system to achieve a biological result for a potential health gain" [1]. This is in reality the definition of functional surgery, which consists of a surgically induced anatomic modification of a normal organ or organ system that produces a functional change aimed at reducing or annulling the altered function causing the disease, or at counteracting the altered function. It can be considered metabolic surgery only if the goal of the functional change is to correct a metabolic alteration, as it is the case of the partial ileal bypass mentioned below. This perspective of the role of surgery in proactive healthcare elevates the discipline beyond the older surgical crafts of incisional, extirpative, and reparative operative procedures. Peptic ulcer surgery was an early example of functional metabolic surgery, since it consisted of operations on normal stomachs and vagus nerves to achieve healing of a distal lesion left untouched by the surgeon. The Program on the Surgical Control of the Hyperlipidemias (POSCH) trial utilized an intestinal operation—partial ileal bypass—to lower plasma LDL-cholesterol and, thereby, retard and even reverse atherosclerotic cardiovascular disease. This NIH-funded trial was the first randomized controlled trial to employ functional/metabolic surgery as the intervention modality [2]. Bariatric or obesity surgery, introduced in 1953, and first mentioned in the literature in 1954 [3] is another example of functional surgery. Thus, surgery for obesity and weight-related disease did not give rise to metabolic surgery but has quite often been correlated to it [4].

Obesity per se has many metabolic implications, and there are few, if any, patients with morbid obesity who are free of concurrent metabolic diseases, which can be partially or totally cured by weight loss. This does not mean that obesity surgery is always metabolic surgery, since the primary indication for surgery is generally the weight reduction, and the metabolic results are to be considered beneficial side effects, whose absence would not influence the indication for surgery. Concentrating on only one aspect of this mosaic limits and indeed renders the treating physician ineffectual. The same is true for the bariatric surgeon who envisions the indications for surgery exclusively by weight standards. The BMI should not be the only reason for treatment. The indication for surgery should mainly be the treatment of weight-related diseases.

The surgeon for obesity and related diseases engages cognitively with the enigmas of obesity, the MSy, and, in particular, with T2DM, and searches for new gastrointestinal and other body organ procedures to mitigate these afflictions independent of weight loss. Furthermore, one must seek the acquisition of knowledge of the neurohormonal networks of these diseases and those created by the surgery. The surgeon expands the concepts of the field to new explorations. Surgeons and other practitioners of surgery for obesity and weight-related diseases should strive for a new freedom of thought and a vast extension of clinical horizons. Interestingly, recent observations demonstrated that individuals with obesity with or without MSy have the same elevated level of mortality risk [5]. This discrepancy highlights the fact that using metabolic risk factors alone as a risk stratification system may not be sufficient to identify individuals with obesity who are at elevated mortality risk, and that a unique risk-stratification system specifically for individuals with obesity is required.

Chapter 2: The Limitations of BMI and Anthropometric Measures When Applied to Individuals as Indications for Surgery

Statement 1

Surgery for obesity and weight-related diseases is a codified discipline that has proven to be effective in the treatment of obesity resulting in long-term weight loss, improvement in or resolution of comorbidities, and the lengthening of life expectancy.

(Level of evidence 1, grade of recommendation A)

In 1991 the Consensus Statement of the NIH Consensus Development Conference codified the first universally accepted guidelines for surgery for obesity and weight-related disease [6]. They assert that a candidate for surgery for obesity and weight-related diseases is an obese patient suffering from obesity with:

- BMI >40 kg/m^2
- BMI >35 kg/m^2 in the presence of specific comorbidities:

- Hypertension
- Ischemic heart diseases
- Type 2 diabetes (T2DM)
- Obstructive sleep apnea syndrome
- Obesity syndrome/hypoventilation (Picwickian syndrome)
- Non-alcoholic fatty liver disease and steatohepatitis
- Dyslipidemia
- Gastroesophageal reflux diseases
- Asthma
- Venous stasis diseases
- Severe urinary incontinence

- Disabling arthropathy
- Severely reduced quality of life

- Between 18 and 60 years of age
- Longstanding obesity (>5 years)

- Proven failure of nutritional and behavioral therapy
- Patients must be motivated and able to provide a valid consent, are willing to undergo periodic inspections and follow an established dietary regime
- Absence of major contraindications (very high operative risk, limited life expectancy due to illness, severe cirrhosis, alcohol abuse/drugs, etc.).

Many studies support the effectiveness of surgery. Some long-term, controlled trials have shown that patients treated surgically obtain significantly better results than patients treated with medical therapy in terms of maintaining the weight loss, the resolution or improvement of comorbidities and, ultimately, reduction of mortality.

For example, the Swedish Obese Subjects (SOS) study showed better results in patients with obesity treated by surgery, compared with patients with similar obesity treated by medical therapy [7–9]. These findings were described for cardiovascular, respiratory, metabolic diseases, and cancer [10–15].

Other studies have revealed that surgery for obesity and weight-related diseases resulted in a significant reduction in mortality from causes related to obesity and comorbidities, particularly T2DM [16–22].

While repeatedly revised and expanded over the years, the NIH 1991 guidelines have remained substantially unchanged in the cardinal principles especially regarding BMI and age of the patients.

Statement 2

The limitations BMI and anthropometric measures when applied to individual patients as indications for surgery.

(Level of evidence 2, grade of recommendation B)

In 1832, Adolphe Quetelet devised BMI as a simple mathematical equation to measure obesity. Since then, BMI has been the most widely used index to assess obesity. This is mainly because it is convenient, straightforward, economical, and usually, has a good correlation with body fat (BF) percentage.

The WHO defines obesity as a condition of excessive fat accumulation to the extent that health and well-being are affected. Obesity is characterized by excess BF which is defined conventionally as BF >25 % in males and >35 % in females [23]. Obesity is linked to an increased risk for a host of diseases such as T2DM, hypertension (HTN), dyslipidemia, coronary artery disease, OSAS, COPD, gout, joint pains, certain cancers, and infertility. In addition, BMI data does not take into account the interracial differences in fat distribution. For example, it is widely acknowledged that Asians have a higher BF percentage than their western counterparts. Wang et al. documented the differences in fat distribution between Caucasians and Asians and showed that Asians at a lower BMI have a significantly higher BF percentage than Caucasians [24]. A possible genetic predisposition to this increased adiposity in "thin" Indians was suggested by Yajnik et al. who went on to coin the term "thin fat baby syndrome" [25]. Due to this increased adiposity, Asians are at a higher risk for MSy even at relatively normal levels of BMI (22 to 23 kg/m^2) [26]. This susceptibility to MSy and T2DM at lower levels of BMI in the Asian population can also be attributed to the "thrifty" gene phenotype, which historically enhanced fat storage in survival conditions, a former benefit that has turned detrimental in the present times of food surplus [27]. It can thus be concluded that Asians develop T2DM at relatively lower levels of BMI and at younger ages, and that they tend to suffer longer from the complications of diabetes.

In terms of treatment of T2DM, although lifestyle modification and pharmacotherapy are the mainstay of therapy, only 7.3 % of all patients achieve good glycemic control with medical therapies [28]. Over the years, strong evidence has emerged in favor of surgery for obesity and weight-related diseases as a treatment option for diabetics with obesity [14]. In the long-term, cause-specific mortality from T2DM has been reported to decrease after surgery for obesity and weight-related diseases [14]. In 2009, the ADA recognized surgery for obesity and weight-related diseases as an effective treatment option for diabetics with obesity [29]. Likewise, in 2011, the IDF also endorsed the use of surgery for obesity and weight-related diseases for diabetics suffering from obesity and who are uncontrolled with medications [30].

Unfortunately, since the time of its inception, patient selection criteria for surgery for obesity and weight-related diseases have been based mainly on BMI. For a considerable time, worldwide use of BMI-based NIH guidelines has denied the benefits of surgery for obesity and weight-related diseases to a large section of individuals who are metabolically obese. In recent years, various consensus meetings such as ACMOMS and ADSS have recommended that the guidelines for bariatric surgery must be more holistic and must use, in conjunction with BMI, other criteria such as waist circumference, metabolic aspects, funcional limits, psychological disorders, and the other features of obesity in conjunction with BMI [31].

The NIH 1991 [6] guidelines have been repeatedly revised and expanded over the years, while remaining substantially unchanged in the cardinal principles especially regarding BMI and age of the patients. At this stage the indications for surgery should be adjusted according to the present actual knowledge and should include new criteria for indications for surgery for obesity and weight-related diseases. The present statement may be the basis on which to develop evidence-based guidelines as directed by the World of Obesity (WOF),

the International Diabetes Federation (IDF) and under guidance and leadership of the IFSO. The basic conditions, that (1) the patients have to be able to provide a valid consent, to be willing to undergo periodic inspections, and to follow an established dietary regime and (2) major contraindications such as very high operative risk, limited life expectancy due to illness, severe cirrhosis, alcohol abuse, drugs, etc.) are absent, remain unchanged.

In the literature, there are numerous studies supporting the effectiveness of surgery for significantly reducing mortality from obesity and related comorbidities. Some of these studies provide controlled, long-term evidence that patients treated surgically obtain significantly better results than patients treated with medical therapy in terms of maintaining the weight loss, resolution or improvement of comorbidities, and ultimately reduction of mortality.

The indications for surgery for obesity and weight-related diseases should be based on the overall assessment of the current health status of the patient with obesity and on the identification of disease risk factors that are not addressed by only the calculation of BMI. These factors should include the following:

- Distribution of adipose tissue as an important cardiovascular and metabolic risk factor; a high amount of visceral fat is often associated with increased liver, muscle, and pancreatic fat and represents a significant BMI independent risk factor with a causal relationship to the MSy (subchapter 4.4) [32–35].
- Different body composition related to gender; at equal BMI, the percentage of adipose tissue is greater in females than in males.
- Individual fat distribution; at equal BMI, distribution between adipose tissue and non-adipose tissue may vary.
- Body composition related to age; a positive correlation between age, visceral fat, and abnormal lipid and glucose metabolism has been demonstrated.
- Body composition linked to race; at equal BMl, the risk of developing T2DM and MSy is greater in individuals originating from Asian countries. In fact, when compared to Western standards, these populations and some other ethnic groups are at high risk and a reduction of the threshold value by 2.5 kg/m^2 compared to Western standards is recommended for obesity classification, [24–27, 36].
- Psychiatric and psycological symptoms (sub-chapter 3.7)
- Limitation of functional aspects (sub-chapter 3.13) [37–39].

It can be concluded from the above that determining a more accurate "phenotype" of the obese patient with obesity is recommended. There needs to be a more careful determination of the percentage of adipose tissue, its body distribution and identification of established clinical parameters, so as to allow for an overall evaluation of the patient with obesity as a candidate for surgery for obesity and weight-related diseases.

It is therefore important to identify new criteria for classification of obesity allowing for the selection of patients as candidates for surgery for obesity and weight-related diseases. New classifications, presently and in the future, should quantitatively represent the health condition of each individual.

A recent method based on the clinical and functional classification of obesity has been proposed, namely the Edmonton Obesity Staging System (EOSS). EOSS classifies obesity in five stages, from 0 to 4, considering physical symptoms, psychological/psychiatric symptoms, and limitation of functional aspects [37–40]. The EOSS stages are as follows:

Stage 0: Patient has no apparent obesity-related risk factors (e.g., blood pressure, serum lipids, fasting glucose, etc. within normal range), no physical symptoms, no psychopathology, no functional limitations or impairment of well-being.

Stage 1: Patient has one or more obesity-related sub-clinical risk factors (e.g., elevated blood pressure, impaired fasting glucose, elevated liver enzymes, etc.), mild physical symptoms (e.g., dyspnea on moderate exertion, occasional aches and pains, fatigue, etc.), mild psychopathology, mild functional limitations and/or mild impairment of well-being.

Stage 2: Patient has one or more established obesity-related chronic diseases requiring medical treatment (e.g., hypertension, type 2 diabetes, sleep apnea, osteoarthritis, reflux disease, polycystic ovary syndrome, anxiety disorder, etc.), moderate functional limitations and/or moderate impairment of well-being.

Stage 3: Patient has clinically significant end-organ damage such as myocardial infarction, heart failure, diabetic complications, incapacitating osteoarthritis, significant psychopathology, significant functional limitations and/or significant impairment of well-being.

Stage 4: Patient has severe (potentially end-stage) disabilities from obesity-related chronic diseases, severe disabling psychopathology, severe functional limitations and/or severe impairment of well-being.

In large epidemiological databases, EOSS staging has been shown to be a more accurate predictor of total mortality than BMI levels in large epidemiological databases and its application for the selection/prioritization of patients with obesity for obesity and weight-related diseases has been suggested.

In parallel with proposals for new classifications, reports have been published that suggest a more careful definition of the predictive parameters of overall operative risk is in order [41–43]. Better clinical diagnosis of patients with obesity and a more careful definition of the operative risk may be of help to reach a therapeutic decision that can be more logical and thoughtful than the simple value of BMI.

The validation and application of EOSS or other alternative staging systems for the selection/prioritization of patients with obesity to surgery for obesity and weight-related diseases

beyond BMI values should be a focus of future clinical research in the field.

Chapter 3: Specific Considerations and Indications for Surgery in the Presence of Weight-Related Diseases

Sub-chapter 3.1: Diabetes and metabolic syndrome
Sub-chapter 3.2: Cardiovascular diseases
Sub-chapter 3.3: Pulmonary diseases
Sub-chapter 3.4: Osteoarthritis
Sub-chapter 3.5: Gastroesophageal reflux disease (GERD)
Sub-chapter 3.6: Hepatobiliary diseases
Sub-chapter 3.7: Mental health
Sub-chapter 3.8: Endocrinopathies and fertility
Sub-chapter 3.9: Cancer and organ transplantation
Sub-chapter 3.10: Pseudotumor cerebri
Sub-chapter 3.11: Chronic inflammation
Sub-chapter 3.12: Urinary tract alterations
Sub-chapter 3.13: Functional status

Sub-chapter 3.1 Diabetes and metabolic syndrome

Statement 3.1.1.

Surgery for obesity and weight-related diseases is a safe and effective therapeutic option for the management of T2DM in patients with obesity. Along with optimal medical treatment and lifestyle adjustment, it has been demonstrated that surgery for obesity and weight-related diseases can achieve a better glycemic control, lower glycosylated hemoglobin, and reduction of diabetes medications than optimal medical and lifestyle treatment alone.

(Level of evidence 1, grade of recommendation A)

In 2013, Guo et al. performed a systematic review and meta-analysis of randomized controlled trials (RCT) in order to assess the effectiveness and the safety of surgery for obesity and weight-related diseases and optimal medical and lifestyle treatment versus optimal medical and lifestyle treatment alone for the management of T2DM. They were able to demonstrate superior results in the surgical group in terms of the reduction of fasting plasma glucose (FDG), glycosylated hemoglobin (HbA1c) and diabetes medications [44]. Three RCTs had been selected, accounting for 270 patients overall, 170 in the surgical and medical therapy group and 100 in the medical therapy group [10, 45, 46]. The surgical procedures performed in these 3 studies were laparoscopic adjustable gastric banding (LAGB), sleeve gastrectomy (SG), gastric bypass (GBP) and biliopancreatic diversion (BPD). Follow-up ranged from 12 to 24 months. The results of the analysis showed that not only could surgery for obesity and weight-related diseases significantly decrease the levels of HbA1c, fasting plasma glucose (FPG) and other metabolites, they also had significantly higher rates of diabetes remission when compared to medical therapy alone. Meanwhile, there were no statistical differences in the serious adverse events between the surgical and medical groups. These data have been confirmed by more recent RCTs. Ikramuddin et al. showed that, at 12 months, 60 randomized patients assigned to intensive lifestyle-medical management and GBP procedure were more likely to achieve the composite goal of HbA1c less than 7.0 %, low-density lipoprotein cholesterol less than 100 mg/dL, and systolic blood pressure less than 130 mm/Hg when compared to those 60 patients who received intensive lifestyle-medical management alone (49 % versus 19 %) [13]. However, since the incidence of serious adverse events was higher in the surgical group than in the medical group (22 versus 15), the authors claimed that the potential metabolic benefits should be carefully weighted with the risks of the surgical procedure [13]. The durability of the metabolic effect of bariatric procedures has been addressed in two RCTs with a follow-up of 3 years. In the first one Schauer et al. randomized 150 patients with obesity and uncontrolled T2DM to receive either intensive medical therapy alone or intensive medical therapy following GBP or SG [10]. The primary endpoint was to reach a Hb1Ac level of 6 % or less at 3 years. This was achieved in a significantly higher percentage of GBP and SG patients (38 % and 24 % respectively), when compared to the medical therapy group. There were more rapid and more sustained reductions in levels of Hb1Ac and FPG and in the use of medications in the two surgical groups compared with the medical therapy group. At 3 years, the daily intake of medications was lower in the GBP group than in the SG group (0.48 ± 0.80 versus 1.02 ± 1.01) and the proportion of patients who were not taking any glucose-lowering medications was significantly higher in the GBP than in the SG group. In the entire cohort, the BMI reduction was the only criteria to be significantly related to the achievement of the primary end point. In contrast with the two surgical groups, for the medical group both the reduction of the BMI and a history of diabetes less than 8 years have shown predictive values for T2DM remission [10]. These data were confirmed by the results of the RCT by Courcoulas et al., where patients were randomized to either an intensive lifestyle weight loss intervention for 1 year followed by a low-level lifestyle intervention for 2 years or surgical treatments (GBP or LAGB) followed by low-level lifestyle intervention in years 2 and 3 [47]. Partial or complete T2DM remission was achieved by 40 % of GBP, 29 % of LAGB, and none of the intensive lifestyle weight loss intervention participants ($P = 0.004$). The use of diabetes medications was reduced more (defined as participants going from using insulin or oral medication at baseline to no medication at year 3) in the surgical groups than the lifestyle intervention–alone group, 65 % of GBP, 33 % of LAGB, and none of the intensive lifestyle weight loss intervention, respectively ($P < 0.001$) [47].

Statement 3.1.2

Surgery for obesity and weight-related diseases has proven to be a cost-effective and, in some instances, a cost-saving approach for the management of patients suffering from obesity and T2DM.

(Level of evidence 2, grade of recommendation C)

T2DM entails substantial lifetime costs, including both direct medical costs related to diabetes and its complications and indirect costs caused by absence from work, reduced productivity at work, disability and premature death. These costs are estimated at 172.000 US$ direct costs and 305.000 US$ indirect costs per patient when diabetes is diagnosed at the age of 50 and 30 years respectively. Over 60 % of the costs are incurred within 10 years of diagnosis [48]. Surgery for obesity and weight-related diseases has demonstrated to be a cost-effective and, in some instances, cost-saving approach for the management of patients suffering from obesity, with or without T2DM [49–51]. It has been calculated that, while the costs for surgery for obesity are substantial in the period from 1 month before surgery to 2 months following surgery, cost savings start accruing from the third month after surgery. Consequently, surgical costs are fully recovered 25 months after the operation [52]. Moreover, in order to specifically assess the economic impact of surgery for obesity in diabetic patients, Warren et al. have proposed a model that applied the population cost estimates for medical care of T2DM to a retrospective cohort of patients with morbid obesity [53]. They compared differences in 10-year medical costs between those having surgery for obesity and weight-related diseases and controls, assuming an incidence of T2DM resolution of 40 % in the bariatric cohort. Considering only the direct medical costs of T2DM, the 10-year aggregate cost savings compared with a control group is $2.7 million/1000 patients; the total (direct and indirect) cost savings is $5.4 million/1000 patients [53].

Statement 3.1.3

Diabetic obese patients with obesity undergoing bilipancreatic diversion/duodenal switch (BPD/DS) achieve the greatest rate of T2DM resolution when compared to the other surgical procedures. GBP and SG have a similar short- to midterm effectiveness on the improvement of glycaemic control, while the antidiabetic effects of LAGB are lower.

(Level of evidence 2, grade of recommendation: B)

A systematic review of the literature by Buchwald et al., accounting for 621 studies with 135,246 patients, reported a T2DM remission in 78.1 % of patients undergoing surgery for obesity, while the incidence of resolution and improvement of diabetic disease was 86.6 % [21]. When considering those studies reporting only diabetic patients, 79.3 % of the participants had resolution of their clinical and laboratory (biochemical) manifestations of type 2 diabetes and 98.9 % had resolution or improvement. Moreover the proportion of patients with T2DM remission or improvement was fairly constant at time points less or more than 2 years [21]. Diabetes resolution was greater for patients undergoing BPD/DS (95.1 %), followed by GBP (80.3 %), gastroplasty (79.7 %) and then LAGB (56.7 %). This review was limited by the quality of the papers with different follow-up, inhomogeneus definition of remission and disparate biochemical measures. [21].

Recently we witnessed the dramatic worldwide adoption of laparoscopic SG. Consequently several clinical randomized and non-randomized trials were performed in order to compare the effectiveness of SG on weight loss and comorbities resolution to that of other bariatric procedures, in particular GBP. Published meta-analysis studies have shown that despite the greater weight loss achieved with the GBP compared with the SG, there are no differences between the two procedures in terms of remission of T2DM [54–59].

Statement 3.1.4

Surgery for obesity and weight-related diseases demonstrated an excellent short- and midterm risk/benefit ratio in patients with class I obesity (BMI 30–35 kg/m^2) suffering from T2DM and/or other comorbidities.

(Level of evidence 1, grade of recommendation A)

The IFSO and the American Society for Metabolic and Bariatric Surgery (ASMBS) recently stated that class I obesity is a well-defined condition deserving treatment because it causes or exacerbates multiple other diseases and decreases both the duration and the quality of life. Current options for the nonsurgical treatment for class I obesity showed little efficacy in the majority of patients in achieving a substantial and durable weight reduction. Both ASMBS and IFSO concluded that surgery for obesity and weight-related diseases should be an available option for patients with class I obesity who do not achieve substantial and durable weight loss and comorbidity improvement with nonsurgical options [60, 61]. These statements are supported by a robust body of literature, including 5 RCTs with high level of evidence [10, 13, 45, 62, 63] and two large meta-analysis/systematic reviews analyzing the outcomes of several prospective and retrospective studies conducted in patients with class I obesity, and T2DM and other comorbidities [64, 65]. The comprehensive evaluation of these studies demonstrated that subjects with class I obesity

undergoing surgery for obesity and weight-related diseases achieve an excellent weight loss and positive effects on glycemic control and diabetes remission. These benefits occur after all of the most established surgical procedures and without substantial differences in respect to the outcomes observed in patients with BMI > 35 kg/m^2.

Statement 3.1.5

Surgery for obesity and weight-related diseases is not effective in patients with Latent Autoimmune Diabetes in Adults (LADA). The diagnosis of LADA patients should be carefully evaluated before considering surgery.

(Level of evidence 3, grade of recommendation C)

The failure to achieve diabetes remission after surgery for obesity and weight-related diseases can occur in patients with longstanding, poorly controlled diabetes or insufficient weight loss, i.e. inadequate loss or regain of weight [66–69]. However, up to 10 % of patients with adult-onset noninsulin-requiring-dependent diabetes are thought to suffer from a form of autoimmune diabetes called latent autoimmune diabetes of adult-onset (LADA). LADA can initially mimic a T2DM but results in a slow destruction of pancreatic beta cells [70]. LADA is characterized by the presence of specific autoantibodies in the peripheral blood, (in particular anti-glutamic acid decarboxylase autoantibodies ((GADA)), low plasma insulin and very low fasting and meal-stimulated C-peptide. LADA usually affects normal weight or overweight patients, aged from 30 to 70, with a diabetes history < 5 years and who start exogenous insulin less than 6 months after the diagnosis [70]. After surgery, patients with LADA may initially respond to oral antidiabetic medication while there are still 20 % of the beta cells functioning, but these patients will progress to insulin-dependent diabetes despite achieving substantial weight loss. The literature concerning the true impact of LADA on diabetic outcomes after surgery is sparse [71, 72]. This is a consequence of the fact that in most of cases, subjects with adult-onset noninsulin-dependent diabetes are assumed to be type 2 diabetics. Conversely, in adults, it is important to differentiate between type 1 and type 2 diabetes when bariatric surgery is being considered, particularly for class I obesity patients [73]. This consideration is supported by the study of Lee et al., who reported that after SG, low fasting C-peptide has been associated with failure to achieve resolution/remission of diabetes [74].

Statement 3.1.6

Type 1 Diabetes Mellitus (T1DM) in combination with morbid obesity is an indication for surgery for obesity and weight-related diseases. Even if there will be no recovery of ß-cell function itself, patients with T1DM will still benefit from the positive effects on all of the other weight-related diseases, as well as reduction in the daily insulin requirements as a result of the decrease in insulin resistance, that is seen with weight loss.

(Level of evidence 4, grade of recommendation C)

To date, fewer than 10 cases of surgery for obesity in patients with T1DM have been reported in the literature. These studies have shown that surgery resulted in a significant weight reduction and an improvement in glycemic control [75–77]. A recent experimental study in a rat model of spontaneous development of T1DM has also shown that a particular type of gastrointestinal bypass (duodenal-jejunal bypass) lowers blood glucose concentration within 2 days after surgery [78]. The aim of the study was to assess the metabolic outcomes, including the glycemic status of patients with T1DM after weight loss surgery. The findings of this study indicate that surgery leads to a remarkable and sustained weight loss in patients with severe obesity and with T1DM. Furthermore, surgery results in significant improvements in their glycemic status and comorbid conditions, despite having prolonged diabetes and undetectable C-peptide. The favorable metabolic effects of surgery for obesity and weight-related diseases may facilitate medical management of T1DM in the setting of morbid obesity.

Statement 3.1.7

Many studies comparing surgery for obesity and weight-related diseases with nonsurgical weight loss therapies have demonstrated greater improvement in the components of the Metabolic Syndrome in the surgically treated patients.

(Level of evidence 2, grade of recommendation A)

The MSy, initially named by Gerald Reaven as syndrome X [79], describes a cluster of conditions including insulin resistance, hypertension, impaired glucose tolerance or T2DM, dyslipidemia characterized by high plasma triglycerides, low high density lipoprotein cholesterol levels, and central weight distribution. Many definitions of MSy have subsequently been developed to define the syndrome across different age groups and ethnicities [80]. Over the past decade the term MSy has lost favor due to a lack of evidence that the cluster of factors represent an additional risk when compared to the individual components [81, 82]. Many randomized trials comparing the effects of weight-related metabolic surgery versus nonsurgical weight loss therapies have demonstrated greater improvement in the components of the MSy in the surgically treated patients (except in the specific domain of elevated blood pressure) [62, 83, 84].

The MSy is also associated with many other features of obesity-related diseases and insulin resistance including non-alcoholic fatty liver disease, obstructive sleep apnea, and the polycystic ovary syndrome. Various forms of an expanded organ- or disease-specific syndrome have been proposed. However, it is now recommended that predictors of individual diseases such as diabetes, sleep apnea, and cardiovascular disease should be assessed individually rather than trying to combine disease predictors into one common entity or syndrome [85].

Sub-chapter 3.2 Cardiovascular diseases

Statement 3.2.1

Obesity, and visceral obesity in particular, is a major modifiable risk factor for cardiovascular diseases (CVD). Weight loss induced by surgery has been shown to reduce CVD risk, with the most relevant reductions in risk observed in the group of patients having the higher CVD risk before surgery. These patients obtain the most significant metabolic improvements thereafter.

(Level of evidence 1, grade of recommendation A)

Obesity is considered a major modifiable risk factor for cardiovascular diseases (CVD). The large prospective studies collaboration epidemiologic survey, including more than 900,0000 adults enrolled in more than 50 prospective longitudinal studies, confirms a strong association between BMI levels and mortality rates, with a particular reference to cardiovascular deaths [86]. However, cardiovascular risk is not homogeneous within the obese population, and it can vary substantially even in patients with the same BMI levels. CVD in obese patients with obesity varies according to age, gender, family history, genetic background, metabolic status, and behavioral factors (e.g. smoking), but the most relevant factor in determining CVD risk in patients with obesity is probably fat distribution. The importance of fat distribution as a CVD risk determinant has been well-documented in the INTERHEART database, a case-control standardized study enrolling 27,0098 participants from 52 different countries [87]. In INTERHEART, the association between BMI levels and the risk of myocardial infarction tends to attenuate after adjustment for the other known classic CVD risk factors, whereas the association between the risk of myocardial infarction and the waist circumference value, an anthropometric marker of visceral fat deposition, remains highly significant even after adjustment [87].

Weight loss induced by surgery has been shown to reduce CVD risk, as estimated by the use of risk calculators or algorithms that combined the effects of single CVD risk factors in an estimation of the 10-year probability of suffering a fatal or nonfatal cardiovascular event (Framingham Risk Score or Prospective Cardiovascular Munster Heart Study PROCAM score). Some reviews and systematic analyses reported in long-term studies improvements in CVD risk after surgery for obesity and weight-related diseases. However, these studies included different types of surgical procedures and some of them did not have a nonsurgical control group [3, 4]. Whereas CVD risk tended to increase in the control groups, a marked and significant reduction of CVD risk estimation has been found in all the surgical groups [88, 89]. The most relevant reduction in CVD risk has been observed in the group of patients with the higher CVD risk who demonstrated the most significant metabolic improvements postoperatively [89, 90].

Statement 3.2.2

Weight loss induced by surgery for obesity and weight-related diseases is associated to a reduction in the incidence of major cardiovascular events in patients with obesity, including myocardial infarction and stroke. Event reductions are more relevant in patients with a high cardiovascular risk before surgery.

(Level of evidence 1, grade of recommendation A)

The SOS study was the first controlled intervention trial to demonstrate that weight loss in subjects with obesity was associated with a reduction of major cardiovascular events [9]. In the SOS study, surgery for obesity and weight-related diseases was associated with a reduced number of cardiovascular deaths (28 events among 2010 patients in the surgery group versus 49 events among 2037 patients in the control group; adjusted hazard ratio [HR], 0.47; 95 % CI, 0.29–0.76; $P = 0.002$). The number of total first time (fatal or nonfatal) cardiovascular events (myocardial infarction or stroke, whichever came first) was lower in the surgery group (199 events among 2010 patients) than in the control group (234 events among 2037 patients; adjusted HR, 0.67; 95 % CI, 0.54–0.83; $P < 0.001$) [9]. One of the more interesting aspects of the SOS study was that both in the surgical group and in the control group the rate of cardiovascular events were not related to the baseline BMI but to the fasting insulin baseline levels. Most of the difference in the events rate between surgical and control group was observed in patients with the highest insulin levels at baseline [9].

More recently, Kwok et al. performed a systematic review and meta-analysis of the studies analyzing the impact of surgery for obesity and weight-related diseases on cardiovascular disease and mortality [91]. Fourteen studies were included, enrolling a total of 29,208 patients undergoing surgery for obesity and weight-related diseases and 166,200 nonsurgical controls. Compared to nonsurgical controls, there was more than a 50 % reduction in mortality amongst patients who had

surgery (OR 0.48 95 % CI 0.35–0.64). In a pooled analysis of four studies with adjusted data, surgery was associated with a significantly reduced risk of composite cardiovascular adverse events (OR 0.54 95 % CI 0.41–0.70). Surgery for obesity and weight-related diseases was also associated with a significant reduction in specific endpoints of myocardial infarction (OR 0.46 95 % CI 0.30–0.69, 4 studies) and stroke (OR 0.49 95 % CI 0.32–0.75, 4 studies) [91].

Finally, from a large administrative health database, Johnson et al. retrospectively analyzed the rates of macro- and micro-vascular events observed in patients with T2DM having had surgery for obesity and weight-related diseases (2,580 cases) or not (13,371 cases) [92]. The authors concluded that surgery for obesity and weight-related diseases was associated with a 65 % reduction of major macro- and micro-vascular events in patients with obesity and T2DM [92].

Statement 3.2.3

Weight loss induced by surgery for obesity and weight-related diseases is associated with a regression or improvement of early structural markers of atherosclerosis (carotid intima-media thickness, brachial flow-mediated dilation, coronary artery calcium score).

(Level of evidence 3, grade of recommendation B)

Thus far, only a few, mostly short-term, uncontrolled studies have demonstrated a regression of early structural markers of atherosclerosis after surgery for obesity and weight-related diseases. Both a reduction of carotid intima-media thickness and an improvement of brachial flow-mediated dilation have been reported 18 months after surgery in 37 patients with obesity treated with GBP or LGB [93]. These findings were confirmed in a long-term observation performed 5 years later in the same patients [94]. Similar results have been reported by Habib et al. in 50 patients 12 months after GBP [95] and by Saleh et al. in 47 patients 10 months after GBP [96]. Sarmiento et al. confirmed a reduction of carotid intima-media thickness in 18 patients 12 months after GBP [97]. Finally, Nerla et al. reported an improvement of brachial flow-mediated dilation 3 months after surgery for obesity in 50 patients [98].

Elevated coronary artery calcium (CAC) is another marker of coronary atherosclerosis that is strongly predictive of cardiovascular events. Priester et al. evaluated CAC with electrocardiographic-gated, non-contrast, CT axial scanning of the chest in 65 GBP patients and 84 nonsurgical patients. At 6 years after surgery, CAC score was significantly lower in patients who underwent GBP than those patients who did not undergo surgery ($P < 0.01$. Additionaly GBP subjects had a lower likelihood of having measurable coronary calcium (odds ratio of CAC > 0 = 0.39; 95%CI of (0.17, 0.90) [99].

Statement 3.2.4

Weight loss induced by surgery for obesity and weight-related diseases is associated with improvement of functional status and symptoms in patients with morbid obesity and with pre-existing ischemic heart disease or heart failure, but the effects on long-term prognosis are not known.

(Level of evidence 3, grade of recommendation B)

Surgery for obesity and weight-related diseases can be performed safely in patients with morbid obesity and with pre-existing ischemic heart disease (IHD) [100, 101]. However, at present, the long-term effect of surgery for obesity and weight-related diseases on the fate of established IHD is difficult to evaluate at present, given the paucity of specific data collected in these particular patients. Only a very few subjects with pre-existing IHD were included in the SOS study (21 in the surgical and 14 in the control group). Weight loss in the surgical group was satisfactory and clinical conditions, defined as the presence of chest pain or shortness of breath, were improved. However, the number of new cardiovascular adverse events, including myocardial infarction, coronary revascularization, and cardiovascular deaths, was not different in the two groups [102].

Similarly, in a small retrospective controlled study performed in patients with obesity and severe heart failure, surgical weight loss was associated with a significant improvement in functional status, but with mixed results for the ejection fraction, with some patients gaining function and other patients not experiencing any change [103]. Hospital readmission at 1 year was, however, significantly lower in the surgical patients than in the controls [103]. Along the same lines, Miranda et al. reported improvements in the quality of life, frequency of exertional dyspnea, and leg edema in 13 patients with heart failure treated with surgery when compared with six nonsurgical controls [104]. Despite these positive results, convincing data demonstrating that weight loss induced by surgery may change the fate of patients with severe heart failure are still missing. In addition, the fact that in epidemiologic studies weight loss in patients with heart failure has been found to be associated with higher mortality rates should be taken into account [105].

Statement 3.2.5

Preliminary results suggest that surgery for obesity and weight-related diseases maybe useful as a bridge to successful heart transplantation in patients with severe obesity and end-stage heart failure.

(Level of evidence 3, grade of recommendation C)

Some small series and case reports have suggested that surgery for obesity and weight-related diseases may be useful in patients with morbid obesity and end-stage heart failure who are not suitable for heart transplantation because of their severe obesity. Reduced body weight permits successful organ transplantation [106–108]. Despite promising results, the experience on this use of surgery for obesity and weight-related diseases as a bridge to successful heart transplantation in patients with severe obesity and end-stage heart failure remains very limited.

Sub-chapter 3.3 Pulmonary diseases

Statement 3.3.1

Surgery for obesity and weight-related diseases may result in resolution/improvement of obstructive sleep apnea syndrome (OSAS).

(Level of evidence 1, grade of recommendation A)

Obesity is a major risk factor for development of OSAS, reported to be up 1.14 times the relative risk for each per unit increase in BMI [109–111]. In turn, OSAS is associated with a higher incidence of MSy and an increased cardiovascular risk [112]. This correlation is supported by the discovery, in several published studies, of the improvement in metabolic homeostasis and blood pressure in patients undergoing treatment of OSAS with positive pressure ventilation [113, 114]. A meta-analysis was conducted by Greenburg et al. Twelve case series (342 patients) were included: five prospective and seven retrospective studies [19]. There was no evidence of publication bias. The pooled mean BMI (10 studies) decreased from 55.3 at baseline to 37 after surgery (LAGB and laparoscopic GBP). The mean apnea-hypopnea index (AHI) decreased from 54.7 events per hour (95 % CI 49.0 to 60.3) to 15.8 events per hour (95 % CI 12.6 to 19.0). The authors concluded that surgery for obesity and weight-related diseases significantly improves obstructive sleep apnea, as measured by the AHI [19].

In contrast, Dixon et al. conducted a 2-year randomized controlled trial involving 60 patients with severe obesity comparing LAGB (30 pts) with conventional weight loss therapy (30 pts) for the management of moderate to severe OSAS [115]. Patients lost a mean of 5.1 kg in the conventional weight loss program compared with 27.8 kg of the surgical group ($P < 0.001$). The AHI decreased by 14.0 events/h (95 % CI, 3.3 to 24.6 events/h) in the conventional weight loss group and by 25.5 events/h (95 % CI, 14.2 to 36.7 events/h) in the surgery for obesity and weight-related diseases group. The between-group difference was −11.5 events/h (95 % CI, −28.3 to 5.3 events/h; $P = 0.18$). Continuous positive airway pressure (CPAP) adherence did not differ between the groups. The authors concluded that in a group of obese patients with severe obesity and OSAS, the use of surgery (LAGB) compared with conventional weight loss therapy did not result in a statistically greater reduction in AHI despite major differences in weight loss [115].

Statement 3.3.2

The respiratory function of the candidate for surgery for obesity and weight-related diseases should be carefully examined by clinical and instrumental investigations such as chest X-ray, pulmonary function tests, arterial blood gas, and by specific questionnaires. If the diagnosis of sleep apnea syndrome is suspected, a nocturnal oximetry or polysomnographic examination is suggested to assess whether a respiratory therapy device such as CPAP, should be used perioperatively.

(Level of evidence 3, grade of recommendation C)

OSAS patients show higher rates of postoperative complications and, in particular, after abdominal surgery [116, 117]. Preoperative respiratory therapy with CPAP has been shown to reduce the frequency of episodes of respiratory failure after extubation and reduce the rate of postoperative complications [118]. However, several studies have demonstrated that there is a close correlation between the extent of the symptoms detected by the specific questionnaires and the severity of the polysomnography framework [119–122]. Consequently, a significant number of patients undergoing surgical procedures are likely to face surgery with an undiagnosed or inadequately treated OSAS. Many different calculation models have been proposed without success. They were based on the use of specific anthropometric and/or clinical parameters. However, it is possible to estimate the severity of OSAS and therefore the need to subject the patient to a polysomnographic examination [123, 124].

Statement 3.3.3

In asthmatic patients, weight loss after surgery for obesity and weight-related diseases results in significant improvement of asthma management, defined as symptoms, level of lung function, and use of medication.

(Level of evidence 3, grade of recommendation C)

The risk of asthma in patients suffering from obesity is two to three times higher than in normal-weight individuals [125]. In addition, obesity significantly impairs asthma management, in terms of symptoms, lung function, and use of medications. A systematic review by Juel et al. demonstrated that weight loss in individuals with obesity and asthma is associated with a 48–100 % remission of asthma symptoms and use of asthma medication [126].

Some retrospective and prospective studies have reported that after surgery for obesity and weight-related diseases, there is a high symptomatic remission rate and significant improvements in asthma management, l, as assessed by symptoms, use of medication, lung function, and hospitalizations [127–132].

Whether this improvement is the result of better mechanical properties of the airways or decreased systemic and bronchial inflammation remains unclear. Van Huisstede et al. reported that surgery for obesity and weight-related diseases in asthmatic patients with obesity improves small airway function and decreases systemic inflammation and the number of mast cells in the airways [133].

A recent study by Dandona et al. demonstrated that following GBP and weight loss, there is a reduction in the expression of key genes involved in asthma pathogenesis including IL-4, MMP-9, LIGHT, LTBR, and ADAM-33 [134]. Because of these changes in gene expression, GBP may provide a potential therapeutic approach to asthma in the morbidly obese.

Sub-chapter 3.4 Osteoarthritis

Statement 3.4.1

In patients undergoing surgery for obesity and weight-related diseases, weight loss results in a substantial improvement in pain and a reduction of disability derived from joint disease.

(Level of evidence 1, grade of recommendation A)

Excess weight is a major "adjustable" risk factor for the development of osteoarthritis. Different epidemiological studies have shown that the risk of developing knee osteoarthritis is 13 to 20 times more likely for patients with obesity when compared to normal-weight individuals. Conversely, the risk of coxoarthritis is 1.7 times higher in individuals with a BMI >28 kg/m^2 compared to subjects with BMI <24.9 kg/m^2 [135–138]. A meta-analysis of randomized clinical trials demonstrated an overall reduction in osteoarthritis after a weekly weight loss of at least 5 % of body weight. Weight loss produced a significant reduction in pain and disability from knee and hip osteoarthritis [139].

Statement 3.4.2

Surgery for obesity and weight-related diseases reduces the incidence of peri- and postoperative complications in patients undergoing knee and hip replacement and reduces the surgical risk for revision of the prosthesis.

(Level of Evidence 3, grade of recommendation C)

Excess weight is an important negative prognostic factor for outcomes of prosthetic joint replacement operations. There is an increased incidence of infections, dislocations, and revision surgery in patients with obesity compared with those of normal weight [140, 141]. However, to date, some published studies have shown that the primary surgical treatment of obesity does not improve the outcome of a subsequent prosthetic replacement procedure [142, 143]. On the contrary, Inacio et al. compared the results of knee or hip arthroplasties in patients who previously underwent surgery for obesity and weight-related diseases with those subjects still awaiting surgery for obesity. They reported a lower postoperative hospitalization rate and a lower incidence of revisional surgery in patients who had undergone surgical treatment of obesity and weight-related diseases compared to those who did not yet have surgery [144]. However, for patients with obesity, who are candidates for prosthetic replacement surgery, preoperative weight loss is still desirable in order to improve the overall health status and the management of diseases associated with obesity.

Sub-chapter 3.5 Gastroesophageal reflux disease (GERD)

Statement 3.5.1

Surgery for obesity and weight-related diseases is effective in controlling GERD and is therefore indicated in patients with morbid obesity who have signs and/or clinical symptoms of severe reflux disease.

(Level of evidence 2, grade of recommendation B)

In the overweight or obese population, the risk for GERD and its complications (erosive esophagitis, Barrett's esophagus, esophageal adenocarcinoma) is 1.5–3 times higher than in normal-weight individuals with an increased risk directly proportional to the increase in BMI [145–150]. Patients with obesity, in particular patients with the so-called central obesity, show signs and clinical symptoms of pathological reflux caused by the increase of abdominal pressure, esophageal and/or gastric motility disorders, and the increased incidence of hiatal hernias [151, 152]. It has been shown that weight loss contributes significantly to an improvement and even resolution of GERD and also increases the sensitivity of the patient to medical therapy with proton pump inhibitors (PPI) [153, 154]. In patients with obesity, surgery for obesity and weight-related diseases, particularly GBP, has shown efficacy similar to that of traditional laparoscopic antireflux surgery (Nissen fundoplication or Toupet fundoplication) in the control of GERD [155–157]. This effect is due not only to the reduction in the proportion of visceral fat following the procedure but also to the abolition of some pathophysiological mechanisms that underly the pathological reflux [157, 158].

Statement 3.5.2

In patients undergoing surgery for morbid obesity, GBP is the procedure of choice for patients with obesity and severe GERD.

(Level of evidence 2, grade of recommendation B)

In a recent review of a prospective US database which analyzed the effectiveness of three surgical procedures (GBP, LAGB, and SG) on GERD in a sample of 22,870 patients, an improvement of reflux symptoms was recorded in a significantly higher percentage of patients undergoing GBP than those undergoing LAGB or SG [159]. GBP exerts an intrinsic "antireflux" action, independent from weight loss, that is mediated by the reduction of acid secretion due to the creation of the small gastric pouch and the diversion of bile flow due to the creation of a Roux limb [157, 158]. This results in a rapid and sustained postoperative control of the symptoms associated with reflux disease [160–162] and in a significant improvement of the complications related to it (eg., Barrett's esophagus) [163, 164]. At present there is only one randomized clinical trial demonstrating the efficacy of GBP as being significantly greater than SG in the resolution of GERD [165].

Statement 3.5.3

GBP is the best option for patients with morbid obesity presenting recurrence of symptoms of GERD after traditional antireflux surgery.

(Level of evidence 2, grade of recommendation C)

In patients with morbid obesity, who suffer from recurrent symptoms of GERD after antireflux surgery, the GBP is a revisional procedure that can result in a rapid and complete resolution of symptoms of reflux in the great majority of patients. However, because of its high technical complexity and increased incidence of peri- and postoperative complications, it is advisable for this procedure to be performed by surgeons with proven experience in surgery for obesity and weight-related diseases [166, 167].

Statement 3.5.4

GERD symptoms are not a contraindication to LAGB. However, the presence of esophageal motility disorders at the time of surgery may reduce the efficacy in terms of reflux symptoms.

(Level of evidence 2, grade of recommendation B)

In a systematic review of 20 short follow-up studies with a total sample of 3307 patients operated by LAGB [168], improvement in GERD symptoms and pH-metric parameters as well as reduction in the prevalence of esophagitis were recorded. However, in the long-term, worsening of reflux symptoms or their de novo appearance were documented. This worsening appears to be related to the progressive inflation of the band and to the development of gastric pouch dilation. An increased incidence of esophageal motility disorders was also highlighted that in some cases has been associated with an increased acid exposure [168, 169].

Statement 3.5.5

GERD symptoms are not a contraindication to sleeve gastrectomy.

(Level of evidence 3, grade of recommendation C)

GERD is the most frequent surgical complication after SG surgery with a mean incidence from 7 to 9 % [170]. However, the influence of SG on symptoms of GERD is still a topic of discussion. Existing studies are only short-term, mostly based on symptoms without objective criteria, and have reported very conflictual results. [171, 172]. The discrepancy can be attributed to the pathophysiological mechanisms related to certain anatomical changes after SG surgery. Some of them seem to promote reflux, while others could exert an antireflux action. [157, 158, 173, 174].

Sub-chapter 3.6 Hepatopbiliary disease

Statement 3.6.1

Weight loss after surgery for obesity and weight-related diseases provides improvement or resolution of non-alcoholic fatty liver disease (NAFLD) and non-alcoholic steatohepatitis (NASH).

(Level of evidence 2, grade of recommendation B)

NAFLD is increasingly recognized as a condition associated with overweight or obesity that may progress to end-stage liver disease. NAFLD histology resembles alcohol-induced liver injury, but occurs in patients without a history of alcohol abuse. NAFLD has a broad spectrum of clinical and histological signs, ranging from simple fatty liver to hepatic steatosis with inflammation, advanced fibrosis, and cirrhosis. The inflammatory stage is known as non-alcoholic steatohepatitis (NASH) [175].

Recent reports indicate that weight loss induced by surgery for obesity and weight-related diseases could be beneficial for NASH treatment. Chavez-Tapia et al. searched The Cochrane Hepato-Biliary Group Controlled Trials Register, the Cochrane Central Register of Controlled Trials (CENTRAL)

and The Cochrane Library, MEDLINE, EMBASE, and Science Citation Index Expanded for randomized clinical trials evaluating any surgical procedure versus no intervention, placebo (sham procedure), or other interventions in patients with NASH regardless of publication status, number of patients randomized, language, or blinding. It appeared that only four studies described hepatic deterioration in the degree of fibrosis. The lack of randomized clinical trials and quasi-randomized clinical studies precludes the correct assesment of the benefits of surgery for obesity and weight-related diseases as a therapeutic approach for patients with NASH. Along the same lines, the limitations of the other studies due to inferior design, do not allow any unbiased conclusions to be drawn concerning surgery for obesity and weight-related diseases as the treatment of NASH [176].

A systematic review of published studies reporting preoperative and postoperative plasma liver enzymes or liver histology was done in patients with obesity and NAFLD undergoing surgery for obesity and weight-related diseases. The data were meta-analyzed using random-effects modeling. The authors revealed that surgery is associated with a significant reduction in the weighted incidence of a number of histological features of NAFLD including steatosis (50.2 and 95 %CI of 35.5–65.0), fibrosis (11.9 and 95 %CI of 7.4–16.3 %), hepatocyte ballooning (67.7 and 95 %CI 56.9–78.5) and lobular inflammation (50.7 and 95 %CI 26.6–74.8 %). Surgery is also associated with a reduction in plasma liver enzyme levels, with statistically significant reductions in ALT (11.36 u/l, 95 %CI 8.36–14.39), AST (3.91 u/l, 95 %CI 2.23–5.59), ALP (10.55 u/l, 95 %CI 4.40–16.70) and gamma-GT (18.39 u/l, 95 %CI 12.62–24.16). However, the heterogeneity of the results was high [177].

In the Practice Guidelines of the American Gastroenterological Association, American Association for the Study of Liver Diseases, and American College of Gastroenterology, Chalasani N et al., recommend that (a) foregut bariatric surgery is not contraindicated in otherwise eligible individuals with obesity who suffer from NAFLD or NASH (but without established cirrhosis); (b) the type, safety, and efficacy of foregut bariatric surgery in otherwise eligible obese individuals with obesity and established cirrhosis due to NAFLD are not established; and (c) it is premature to consider foregut bariatric surgery as an established option to specifically treat NASH [178].

In any case in the majority of studies, weight loss after surgery appeared to provide improvement or resolution of obesity and MSy associated abnormal liver histological features in subjects with severe obesity [179].

Statement 3.6.2

Cholecystectomy performed during surgery for obesity and weight-related diseases is suggested only for patients with biliary symptoms or patients with evidence of gallstones as documented during preoperative ultrasonography.

(Level of evidence 2, grade of recommendation B)

Obesity is a risk factor for cholelithiasis. It increases biliary secretion of cholesterol and decreases gallbladder contractility [180, 181]. Other risk factors for cholelithiasis after surgery for obesity and weight-related diseases include rapid weight loss and the malabsorption that occurs postoperatively. Gallstone formation appears to occur most commonly in the first 6 months following GBP, as documented in a study by Nagem [180]. The debate regarding routine versus selective cholecystectomy has been extensively studied in patients undergoing GBP, but there is limited data for patients undergoing LAGB, SG, and BPD [182]. Some authors suggest routinary cholecystectomy; others suggest cholecystectomy only for patients with biliary symptoms or those with documented evidence of gallstones during preoperative ultrasonography [183]. The argument against removing the gallbladder at time of surgery for obesity and weight-related diseases was based on the assumption that the risk of developing symptomatic cholelithiasis is not significantly higher after GBP than in the general population, particularly with the routine use of prophylactic ursodeoxycolic acid after surgery [184]. Additionally, laparoscopic cholecystectomy is technically more challenging to perform in patients with morbid obesity, which may result in higher complication and open conversion rates [185]. Conversely, if biliary symptoms occur, laparoscopic cholecystectomy would be easier and safer to perform after the initial weight loss. It should however be mentioned that conventional ERCP may not be possible after RYGBP which implies that prophylactic cholecystectomy might be considered more favorably for GBP patients versus those patients having other procedures.

Statement 3.7 Mental health

Statement 3.7.1

Obesity is associated with a significant psychosocial burden. Some candidates for surgery for obesity and weight-related diseases present with significant psychopathology which may impact the outcome of surgery, and, in some cases, represent a contraindication to surgery.

(Level of evidence 2, grade of recommendation C)

Several studies have identified the presence of psychopathology according to the Diagnostic and Statistical Manual of Mental Disorders V (DSM-V) in candidates for surgery for obesity and weight-related diseases [186–189]. Current American and European guidelines, as well as some reviews [190–192] have emphasized that the presence of specific psychiatric disorders are considered risk factors for suboptimal outcomes after surgical treatment. These disorders include

schizophrenia and schizoaffective disorders, psychosis, bipolar disorder, substance abuse disorders, eating disorders (bulimia, BED, and NES), neurocognitive disorders and personality disorders. Treatment with certain psychotropic medications, including antipsychotics and mood stabilizers, previous psychiatric hospitalizations, as well as history of suicide attempts or other self-injurious behaviors also are widely considered risk factors for poor postoperative outcomes. Some of these conditions, in particular severe, uncontrolled psychosis, bipolar disorder, and substance abuse are widely considered contraindications to surgery [193, 194].

Statement 3.7.2

Mood and anxiety disorders are considered negative predictors for the outcome of surgery for obesity and weight-related diseases, but not a contraindication for treatment, provided the patient is receiving appropriate mental health treatment.

(Level of evidence 2, grade of recommendation A)

Studies have suggested that individuals diagnosed with mood and anxiety disorders prior to surgery for obesity and weight-related diseases experience smaller weight losses postoperatively [195–198]. The causes for this are not well understood, but could be both behavioral or biochemical in nature. Some studies have suggested that eating foods with high fat content promotes negative emotional states that activate brain circuits of the rewarding systems [199–203]. Weight reduction activates specific receptors, inducing less sensitivity to stress and results in improvement of the MSy [204]. However, mood and anxiety disorders are not considered contraindications for bariatric surgery unless the conditions are severe and untreated. Mood and anxiety symptoms should be monitored carefully both before and after surgery.

Statement 3.7.3

Severe and untreated bipolar disorder is generally considered a contraindication to surgery for obesity and weight-related diseases both for its symptoms and for the difficulty in stabilizing drug treatment in the postoperative period. Similarly, severe and unstable schizophrenia and psychosis also are contraindications to surgery for obesity and weight-related diseases.

(Level of evidence 2, grade of recommendation C)

Disturbances of the "bipolar spectrum" are characterized by mood swings with alternating phases of hyperthymia and inhibition. This functional dysregulation results in the development of alterations in the thymus (psychopathology mood), the thought processes (alteration of the form and content of thought), motility and behavioral initiative, as well as in neurodegenerative manifestations (abnormal levels of energy, appetite, libido, the sleep-wake cycle, etc.). Bipolar disorders typically require long-term pharmacotherapeutic treatment. The neuroleptics, in particular, and most antidepressants, are known to induce weight gain as a side effect [205]. In addition, the absorption of these drugs is believed to be impacted after GBP surgery. The impact of the SG and LAGB procedures on absoption of these medications is less well established [205–212]. There are few studies of postoperative outcomes for individuals with schizophrenia or acute psychosis. However, the severity of these conditions, the difficulty that many patients have with medical and pharmacological compliance, and the concerns about absorption of the medication used to treat the conditions have led experts to conclude that these conditions, when not optimally controlled, are contraindications to surgery for obesity and weight-related diseases.

Statement 3.7.4

Active or recent substance abuse and dependence, including alcohol abuse, is a contraindication to surgery for obesity and weight-related diseases.

(Level of evidence 3, grade of recommendation C)

Several studies have suggested that alcohol dependence is a negative prognostic factor for postoperative outcomes [212–216]. Several studies have found an increase in the consumption of alcohol following surgery for obesity and weight-related diseases [217–220]. Moreover, as demonstrated by studies on the effects of alcohol on the brain, there is clear evidence for a greater sensitivity to ethanol after surgery, especially after GBP. This greater sensitivity to alcohol seems to be less in LAGB patients [221–224]. Moreover, vitamin deficiencies after GBP, especially thiamine, can result in the onset of acute Wernicke's encephalopathy and/or Korsakoff syndrome [225]. Studies on the effects of cognitive behavioral therapy before surgery for obesity to reduce dependence on alcohol showed no significant effect in the long-term follow-up of patients with substance dependence [226]. Furthermore, there is a concern that some individuals with a history of substance abuse or dependence prior to surgery may postoperatively develop other compulsive or addictive behaviors, such as binging, compulsive shopping, gambling and, more rarely, drug abuse [227]. The prevalence of this phenomena, and the factors associated with it, are not well understood at this time.

Statement 3.7.5

Patients with binge eating disorder (BED) are likely to achieve less postoperative weight loss than patients

without BED. Therefore, BED should be evaluated by the a multidisciplinary team before and after surgery for obesity and weight-related diseases.

(Level of evidence 3, grade of recommendation B)

The presence of BED is common among patients undergoing surgery. Several studies as well as a recent meta-analysis [194] have suggested that individuals with BED prior to surgery experience less postoperative weight loss as well as greater psychosocial distress postoperatively. For these reasons, the presence of BED should be assessed by the multidisciplinary team both before and after surgery. The condition is only considered a contraindication to surgery for obesity and weight-related diseases when the behavior is severe, untreated, and the multidisciplinary team is confident that the behavior would negatively impact postoperative outcomes.

Statement 3.7.6

Bulimia nervosa is considered a contraindication for surgery for obesity and weight-related diseases.

(Level of evidence 2, grade of recommendation B)

Bulimia nervosa is relatively rare among individuals who present for surgery for obesity and weight-related diseases. However, it is believed to be a contraindication for surgery [228, 229]. Patients with the diagnosis are recommened for psychiatric treatment and a period of symptom remission prior to being offered surgery for obesity and weight-related diseases.

Statement 3.7.7

Patients with the night eating syndrome (NES) are likely to achieve less postoperative weight loss after surgery for obesity and weight-related diseases than patients without NES. Therefore, NES should be evaluated by the multidisciplinary team before and after surgery.

(Level of evidence 3, grade of recommendation C)

Relatively few studies investigated the relationship between the NES in patients undergoing surgery for obesity and weight-related diseases and postoperative outcomes [190, 194, 230–232]. Those studies have suggested that the NES, like BED, can negatively impact postoperative outcomes. For these reasons, the presense of the NES should be assessed by the multidisciplinary team both before and after surgery for obesity and weight-related diseases. The condition is only considered a contraindication to surgery when the behavior is severe, untreated, and the multidisciplinary team believes that the behavior would negatively impact postoperative outcomes.

Sub-chapter 3.8 Endocrinopathies and fertility

Statement 3.8.1

Endocrinopathies that are responsible for secondary obesity or that require therapeutic intervention represent contraindications to surgery for obesity and weight-related diseases. Their diagnostic classification and treatment are in fact necessary to support the success of surgery and to reduce the perioperative morbidity and mortality.

(Level of evidence 4, grade of recommendation C)

The routine assessments of thyroid, adrenal, and other endocrine gland functions are advisable in the presence of medical history or clinical features that suggest pathologies of the same nature. [233–236]. It is recommended that screening for Cushing's syndrome be carried out by the dexamethasone suppression (1 mg) night test because patients with severe obesity may have clinical characteristics related to hypercortisolism which are quite often hardly recognizable [233, 237, 238]. Lastly, it is useful to exclude the presence of hypoparathyroidism in patients previously treated with total thyroidectomy [239, 240], as surgery for obesity and weight-related diseases might cause or aggravate hypocalcemia [241–243].

Statement 3.8.2

Inadequate drug treatment of pre-existing endocrine medical conditions is a contraindication to surgery for obesity and weight-related diseases. In fact, the re-evaluation and optimization of the treatment of these conditions are necessary to reduce perioperative morbidity and mortality.

(Level of evidence 3, grade of recommendation C)

In patients with hypoparathyroidism, calcium and calcitriol treatment must be implemented prior to surgery for obesity and weight-related diseases [239, 240, 244]. Although surgery results in a significant reduction in serum levels of uric acid [245], prophylactic treatment should be considered in patients with a history of gout to prevent acute attacks. It is believed that these attacks occur more frequently after surgery for obesity and weight-related diseases than after other types of upper abdominal surgery [246]. It is recommended to discontinue estrogen therapy before surgery both in premenopausal and in postmenopausal women to reduce the risk of thromboembolic events in the postoperative period [247]. While the transdermal administration of progestogen preparations results in a

lower risk of deep vein thrombosis than oral administration [248, 249], there is no data to demonstrate the safety of this treatment in patients who are being considered for surgery for obesity and weight-related diseases.

Statement 3.8.3

In women with obesity, weight loss should be considered the first line of treatment for infertility regardless of the presence or absence of polycystic ovary syndrome. Weight loss can be obtained by lifestyle therapy, pharmacologic therapy, or surgery for obesity and weight-related diseases.

(Level of evidence: 2, grade of recommendation B)

Obesity has a detrimental effect on female fertility [250]. The relative risk of infertility secondary to anovulatory cycles is 2.7 times higher in women over the age of 18 whose BMI is higher than 32 kg/m^2 [251]. For women having ovulatory cycles, the chance of conception is decreased by 5 % for every BMI increase by one unit [252]. The etiologies of this decrease in fertility are multivariate and include higher leptin and lower adiponectin levels. Additionally, the expression of steroids in the ovaries is altered and, in conjunction with elevated insulin levels, cause an inhibition of the sex hormone-binding globulin production in the liver which ultimately results in hyperandrogenemia [253]. Reduced fertility is also due to the higher incidence of polycystic ovary syndrome in women with obesity [254]. Weight loss in women with polycystic ovary syndrome, obtained by lifestyle therapy, pharmacological therapy, and surgery for obesity and weight-related diseases, improves spontaneous ovulation and pregnancy rates [254]. Since weight loss prior to conception improves live birth rates in women suffering from obesity with or without polycystic ovary syndrome, it has to be considered the first line therapy for infertility in women with obesity [255].

Statement 3.8.4

In women with obesity the risk for a wide range of maternal and fetal complications in pregnancy is reduced by weight loss. If weight loss cannot be obtained by nonsurgical management, surgery for obesity and weight-related diseases is an option for these women.

(Level of evidence 2, grade of recommendation C)

In pregnant women, obesity increases the risk for suffering complications such as preeclampsia, hypertension, gestational diabetes, and the need for delivery by cesarean section [256–258]. Not only is the pregnant woman herself at risk, the children of pregnant women suffering from obesity are at a higher risk for stillbirth, prematurity, congenital abnormalities, macrosomia, and obesity [259, 260]. With a BMI between 30 and 39.9 kg/m^2, the relative risk for gestational diabetes is increased 4.0 times, the relative risk for gestational hypertension up to 3.2 times, and the risk for preeclampsia up to 3.3 times, compared to individuals with BMI under 30 kg/m^2. Therefore, preconception assessment of and counseling on obesity are highly encouraged [261]. If a normal body weight cannot be obtained by conservative treatment, surgery for obesity and weight-related diseases maybe considered. After surgery for obesity and weight-related diseases, the complications of pregnancy, such as gestational diabetes, preeclampsia, gestational hypertension, and macrosomia are less likely to occur [262, 263].

Sub-chapter 3.9 Cancer and organ transplantation

Statement 3.9.1

Surgery for obesity and weight-related diseases reduces the incidence of some malignancies and the mortality related to them.

(Level of evidence 3, grade of recommendation C)

Obesity is associated with an increased risk of developing malignancies, especially gastrointestinal, genito-urinary, reproductive, and hematopoietic cancers [264–266]. In the USA, 14 % of cancer deaths are attributed to obesity; this percentage reaches 20 % if we consider only female individuals. Furthermore, it was estimated that the hypothetical correction of the excess weight would have been able to prevent about 900,000 cancer deaths in the US population [267]. Although there are no randomized clinical trials, several studies conducted on very large samples of patients showed a significant decrease in the incidence of cancer and cancer-related mortality in patients undergoing surgery for obesity and weight-related diseases compared to obese non-operated patients [268–270]. This reduction appears to be more pronounced in women than in men [8].

Statement 3.9.2

Obesity is a risk factor for developing postmenopausal breast cancer and is also a predictor for a poor prognosis in breast cancer patients. The reduction of body weight by lifestyle changes, medications, or surgery for obesity and weight-related diseases reduces the risk for breast cancer and related mortality.

(Level of evidence: 3, grade of recommendation B)

Whereas obesity reduces the risk to develop a premenopausal breast cancer, it increases the risk to develop a

postmenopausal breast cancer [271–273]. About 25 % of breast cancer cases after menopause are in women with obesity [271, 272]. A weight gain of only 10 kg between the age of 18 and menopause increases the risk of postmenopausal breast cancer by 16 % [274, 275]. A BMI over 25 kg/m^2 increases the breast cancer risk proportionally. Five BMI units increase mortality within the range of 12–20 % [271–273]. However, obesity does not only increase the risk of developing breast cancer but it is also correlated with a shorter overall survival in patients with breast cancer [276]. A BMI higher than 27 kg/m^2 triples the risk for a breast cancer patient to die from the cancer [277, 278]. The reduction of body weight leads to a decrease in the risk of developing breast cancer [279, 280].

Statement 3.9.3

Weight loss in women with obesity reduces the risks of endometrial cancer development and related mortality. Surgery for obesity and weight-related diseases is one of the options for achieving weight loss and for reducing endometrial cancer risk.

(Level of evidence 3, grade of recommendation C)

Obesity is a well-known risk factor for endometrial cancer, with a direct link between body weight and the risk of developing the disease [271]. Being obese increases the risk for endometrial cancer in women by a factor of 2 to 3 [281, 282]. Being overweight by 25 kg increases the risk by a factor 10 [283]. Additionally, whereas endometrial cancer is a curable disease, the mortality risk is also increased for women with obesity [284, 285]. The increased risk of endometrial cancer is thought to be due to the "unopposed estrogen hypothesis." The increased estrogen and androgen levels along with hyperinsulinemia in women with obesity lead to mitogenous effects on the endometrium, especially after menopause, when these hormones are no longer opposed by progestin [286]. There are preliminary data showing that weight loss after surgery for obesity and weight-related diseases may reduce the risk for endometrial cancer by as much as 70 %, provided the women do not regain the lost weight [287–289].

Statement 3.9.4

In patients with obesity who have a history of cancer, surgery for obesity and weight-related diseases is indicated only in selected cases with proven remission of tumors, provided the absence of signs that suggest a possible relapse and provided the history of neoplasia is associated with a reasonably long life expectancy.

(Level of evidence 3, grade of recommendation C)

Given the exponential increase in the number of surgery for obesity and weight-related diseases procedures performed worldwide each year [22], it is increasingly likely that a candidate for surgery for obesity and weight-related diseases has previously received medical and/or surgical treatment for a malignancy.

To date, there is only one published paper in the literature that retrospectively analyzes the relationship between surgery for obesity and weight-related diseases and cancer. A group of 58 patients was extrapolated from a cohort of 1566 patients with obesity who underwent surgery for obesity and weight-related diseases, in whom the neoplastic disease was first diagnosed, respectively, before (40 patients), during (2 patients), or after (16 patients) the surgical procedure. In light of these results, the authors conclude that a previous diagnosis of cancer is not a contraindication to perform a surgery for obesity and weight-related diseases if remission of the neoplastic disease is complete and there are no suspicions of possible recurrence or metastasis [290].

Statement 3.9.5

Surgical treatment of obesity and related diseases is an effective therapeutic option with an acceptable rate of complications and postoperative mortality for both patients with obesity awaiting organ transplant and patients who have received an organ transplant.

(Level of evidence 3, grade of recommendation C)

Given its exponential distribution, the diagnosis of obesity is increasingly common among patients undergoing organ transplantation [291–298]. Within the therapeutic management of the patient suffering from obesity who is a candidate for organ transplant, the role of surgery for obesity and related diseases before, during, or after transplantation, has only been described in a few case reports or papers on small groups of patients. [106, 108, 299–308]. Surgery for obesity and related diseases has been shown to increase eligibility for a transplant (in some cases, weight loss constitutes the indication for surgery) [108, 307, 308]. For patients with obesity who have already undergone transplant surgery, the weight loss after surgery for obesity and weight-related diseases is quite similar to that achieved in non-transplant candidates who are obese, but with an increase in peri- and postoperative complications and mortality [293–296, 309]. This increased incidence of adverse events can be judged acceptable in view of the functional status of patients undergoing surgery for obesity and related diseases.

Sub-chapter 3.10: Pseudotumor cerebri

Statement 3.10

Weight reduction is recommended for patients with obesity suffering from pseudotumor cerebri or idiophatic intracranial hypertension (IIH).

(Level of evidence 3, grade of reccomendation C)

Pseudotumor cerebri, also called idiopathic IIH, is defined by an elevated intracranial pressure with normal cerebrospinal fluid (CSF) composition and no evidence of other findings on neuroimaging or other evaluations. Typical symptoms of IIH are headache, papilledema, and vision loss [310]. The overall annual incidence of IIH among the general population is approximately two per 100,000. However, it is especially high among young women suffering from obesity, which remains one of the most important risk factors [311–313]. A theory by Sugerman et al. suggests that among patients with obesity, increased intra-abdominal pressure may result in an increase in pleural and cardiac filling pressures, which in turn increases central venous pressure, and ultimately decreases CSF absorption by reducing the pressure gradient between the dural venous sinuses and the subarachnoid space [314]. There are different medical (carbonic anhydrase inhibitors, topiramate, oral steroids) and surgical approaches (ventriculo- or lumboperitoneal shunting and stenting of the transverse venous sinus stenoses), but there are no randomized controlled trials prospectively assessing and comparing these treatments. Ventriculo- or lumboperitoneal shunts are widely used but they have a high frequency of failure [312, 315]. Weight reduction is recommended for all patients with obesity and with IIH. Sugerman demonstrated that surgery for obesity and weight-related diseases is the long-term procedure of choice for severely patients with obesity and IIH. It is shown to have a much higher rate of success than CSF-peritoneal shunting, as well as providing resolution of additional obesity comorbidity [316]. Cohort studies, case series and a retrospective review confirm reduction in intracranial pressure, symptom prevalence, and improvement of papilledema and visual fields can be obtained with a salt-restricted and low-calorie diet [316–326].

Sub-Chapter 3.11 Chronic inflammation

Statement 3.11.1

Obesity leads to chronic inflammation resulting in multiple inflammation-triggered diseases. Surgery for obesity and weight-related diseases improves chronic inflammation status and appears to be an immune restorative procedure. This issue is considered as a supporting indication for surgical treatment of obesity and weight-related diseases.

(Level of evidence 3, grade of recommendation C)

New findings in the pathophysiology of adipose tissue support the intimate relationship between the adipose tissue and the hematopoietic system [327, 328]. Several studies report that chronic systemic inflammation in obesity originates from local immune responses in visceral adipose tissue. Expansion of adipocytes and a concomitant reduction in capillary density and blood flow lead to oxidative stress and endoplasmic reticulum stress in adipocytes, resulting in increased macrophage infiltration, abnormal cytokine production, and increased acute-phase reactants, thus causing chronic inflammation [329–332]. Chronic inflammation directly promotes insulin resistance and type 2 diabetes mellitus, cardiovascular disease, and increased cancer risk [333–336]. Surgically induced weight loss improves inflammatory mediators such as acute-phase proteins and cytokines. Abnormal levels are described to reverse rapidly after LAGB, vertical banded gastroplasty (VBG) and GBP [337–340]. Thus, surgery for obesity and related diseases leads to an improvement of the chronic inflammation status and in a prevention of inflammation-triggered diseases.

Sub-chapter 3.12 Renal alterations

Statement 3.12.1

Surgery for obesity and weight-related diseases improves renal function in patients with obesity with or without type 2 diabetes.

(Level of evidence 2, grade of recommendation C)

In the SOS study with a median follow-up of 10 years, hyperalbuminuria (defined as urinary albumin excretion of >30 mg per 24 h) among the 1498 patients in the surgery group and 1610 controls without hyperalbuminuria at baseline, occurred in 246 participants in the control group and in 126 in the surgical group, corresponding to an incidence of 20.4 and 9.4 per 1000 person years [341]. No RCT have been performed comparing the effects of surgery for obesity and weight-related diseases with nonsurgical therapies on hard renal endpoints or markers of diabetes-related kidney disease [342]. Nonetheless, results of the studies published, thus far, are consistent in pointing towards improved outcomes [92, 343–348]. A reduction in the median albumin/creatinine ratio (ACR) after 6 months from surgery has been shown. While the reduced ACR after GBP correlated with postoperative insulin resistance, it did not correlate with postoperative BMI. Retrospective analysis of prospectively collected data in a cohort of 52 patients undergoing GBP, SG, or LAGB and followed up for 5 years, showed that 58 % of patients achieved remission (an ACR <30 mg/g) with favorable outcomes correlating with postoperative weight loss and blood pressure [347]. In general terms, improvements are particularly pronounced in the subgroup with preoperative hyperalbuminuria and did not correlate with reductions in BMI.

Statement 3.12.2

Chronic renal failure requiring dialysis should not be considered a contraindication to surgery for obesity and weight-related diseases.

(Level of evidence 2, grade of recommendation B)

A retrospective review of a prospectively collected database was conducted for dialysis patients who underwent surgery for obesity and weight-related diseases. From the 3048 patients who had undergone surgery, only 0.7 % were dialysis patients. Chronic renal failure requiring dialysis should not be considered a contraindication to surgery for obesity and weight-related diseases since excellent medium-term weight loss and an acceptable (albeit increased) risk/benefit ratio are observed [349]. For subjects who are severely obese or unable to undertake an exercise program, surgery for obesity and weight-related diseases is recommended.

Statement 3.12.3

Surgery for obesity and weight-related diseases can be used as a bridge to renal transplantation in patients with renal failure who suffer from obesity, type 2 diabetes, or both.

(Level of evidence 3, grade of recommendation C)

Surgery for obesity and weight-related diseases has been proposed as a bridge to renal transplantation in patients with renal failure who suffer from obesity, type 2 diabetes, or both. Small case studies of patients with end-stage renal disease have shown that surgery reduces weight and its associated comorbidities, making renal transplantation safer and potentially more successful [350]. Outcome measures of more than 209,000 renal transplant recipients demonstrated significant differences in favor of factors such as lower BMI (<30 kg/m^2); lower mortality; delayed graft function; acute rejection; 1-, 2-, and 3-year graft survival; 1-, 2-, and 3-year patient survival; wound infection and dehiscence; length of hospital stay; operation duration; hypertension; and incisional hernia [351]. Therefore, end-stage renal disease patients with a BMI >30 kg/m^2 should preferably lose weight prior to renal transplantation. If this cannot be achieved with nonsurgical measures, surgery for obesity and weight-related diseases could be considered in renal transplant candidates who are morbidly obese.

Statement 3.12.4

Improvement in urinary incontinence may be an important benefit of surgery for obesity and weight-related diseases.

(Level of evidence 3, grade of recommendation C)

A study on 2458 participants of ten obesity centers and 3 years follow-up, showed that weight loss was related to urinary incontinence remission. Among women and men with severe obesity, surgery for obesity and weight-related diseases was associated with substantially reduced urinary incontinence over 3 years [352].

Sub-chapter 3.13 Functional status

Statement 3.13.1

Obesity is associated with poor physical functioning. Weight loss induced by surgery for obesity and weight-related diseases has been shown to improve objective measures of physical functioning. Initial data suggest that the physical functioning of bariatric patients might also be further improved by participation in physical exercise training programs.

(Level of evidence 2, grade of recommendation A)

Obese adult patients with obesity frequently have marked impairment in physical functioning, as measured by the ability to perform simple physical activities (walking, getting out of a chair, climbing stairs) [353]. Nine longitudinal observational studies reporting objective measures of physical functioning in adults with obesity before and after surgery for obesity and weight-related diseases were recently identified and reviewed [353]. The 6-min walk test (6MWT), which measures the maximal distance a participant can walk in 6 min, was reported in seven studies [354–360], and found to be improved after surgery in all of them, with a relative increase after surgery ranging from 8.8 to 33.3 % [353]. The timed up-and-go (TUG) test, which measures the time taken to get up, walk 3 min, turn around, walk back, and sit down, was reported in three studies [349, 359–361], and also found to be improved after surgery in all of them [353]. Finally, two studies [357, 362] demonstrated a significant improvement in global physical performance, as tested by the short physical performance battery (SPPB), a three-component test in which balance, walking time, and chair rise were assessed [353].

In the same review [353], six studies evaluated physical performance with exercise testing protocols [358, 363–367]. Exercise capacity improved in all studies. Where reported, peak oxygen uptake markedly improved in relation to body weight, suggesting improved aerobic fitness. However, absolute values were either unchanged or decreased, possibly because of the unavoidable loss of muscle mass that accompanies rapid surgical weight loss. This pattern suggests that improvement in exercise capacity may be more related to a mechanical advantage attributable to weight loss, and not to absolute improvements in cardiorespiratory or muscle function [353].

Physical activity during weight loss is known to be beneficial and combined resistance and aerobic training has been shown to have the most favorable outcome on aerobic fitness [353]. Castello et al. prospectively randomized 32 eligible morbidly obese women treated with GBP to an aerobic exercise training program group or to a control group. The "walking distance at 6-min walk" test increased after surgery only in the group undergoing the physical training program [368]. Stegen et al. divided 15 morbidly obese patients treated with GBP in a mixed strength and endurance training program group and in a control group. Weight loss in the control group resulted in a decrease in muscle strength and no improvement in aerobic capacity. As a consequence, most components of functional capacity did not improve. In contrast, muscle strength, aerobic capacity, and functional capacity were all significantly improved in the training group [369].

Statement 3.13.2

Work absenteeism due to sick leave and disability-related early retirement is higher in workers with obesity. Weight loss induced by surgery for obesity and weight-related diseases results in a reduction of sick leave and may be associated with favorable effects on disability pension in men.

(Level of evidence 2, grade of recommendation A)

Obese workers generally have higher work absenteeism by sick leave than their normal-weight colleagues [370]. Having a BMI above 50 kg/m^2, lower levels of education, and suffering from four or more comorbidities were found to be significant predictors of sick leave in a morbidly obese population [371]. Moreover, the productive life of patients with obesity is shorter than in non-obese subjects not only because of premature mortality but also because of earlier retirement due to disability. In Sweden, the use of disability pension was 2.3 times higher in men with morbid obesity and 2.7 times higher in women with morbid obesity than in the general population [372]. Most of these disability pensions were generated by cardiovascular diseases and orthopedic problems related to arthritis, both conditions that are known to be preventable with weight loss [372]. The loss of work productivity related to sick leave and disability retirement has a profound impact on the general well-being and quality of life of individuals who are obese and generates enormous economic costs for the society [370].

The effects of surgically induced weight loss on sick leave and disability pension have been analyzed in the SOS study [373, 374]. In the year prior to treatment, adjusted average number of days of sick leave plus disability pension was similar in surgical patients and controls [373]. Compared with controls, the surgical group had 35 % more days of sick leave during the first year after surgery, but 10–14 % fewer days during years 2–3. At year 4, the total number of days of sick leave tended to be lower in the surgical group [373]. The reduction in sick leave days observed in the surgical group during years 2–3 after surgery for obesity and weight-related diseases was more significant in patients aged 47–60 years than in younger patients [373]. In a more recent report covering an extended 10-year follow-up period, SOS investigators reported that when adjusting for baseline confounders, a reduced risk of disability pension was suggested in men in the surgery group (hazard ratio 0.79, 95 % confidence interval 0.62–1.00; $P = 0.05$). Moreover, the adjusted average number of disability pension days was lower in the surgical group [374]. In conclusion, results from the SOS study suggest that surgery for obesity and weight-related diseases results in a reduction of sick leave and may be associated with favorable effects on disability pension in men.

Chapter 4
General considerations for indications of surgery for obesity and weight-related diseases
Sub-chapter 4.1: Quality of life
Sub-chapter 4.2: Adolescents
Sub-chapter 4.3: Elderly
Sub-chapter 4.4 : Psychology and eating disorder
Sub-chapter 4.5: Body composition
Sub-chapter 4.6: Low BMI
Sub-chapter 4.1: Quality of life

Statement 4.1.1

Surgery for obesity and weight-related diseases has proven to be effective in determining the overall improvement of the quality of life of patients suffering from obesity.

(Level of evidence 1, grade of recommendation A)

Excess weight leads to an overall deterioration of quality of life (health-related quality of life—HRQL) that can affect both the psychosocial and the physical dimensions. The higher the degree of obesity, the greater the deterioration [375]. Other factors such as age (over 35 years), female gender, and the presence of comorbidities may aggravate the burden of obesity on the physical, mental, and social variables [376, 377]. In contrast, weight loss has a beneficial effect on HRQL that is directly proportional to the amount of weight lost [378, 379]. This effect is therefore "magnified" by surgery for obesity and weight-related diseases that results in significantly greater weight loss [380–384]. In terms of quality of life, teenagers and individuals with a BMI between 30 and 35 kg m^2 similarly benefit from surgery for obesity and weight-related diseases [385, 386]. Numerous published studies, including randomized clinical trials, compare the effects of surgery for obesity and weight-related diseases and the outcome of different

methods aiming at the dietary-behavioral well-being of the individual. These studies unequivocally show the superiority of surgery for obesity and weight-related diseases for improving the psychosocial and mental components that characterize the individual HRQL [62, 115, 380, 387–391].

Statement 4.1.2

The improvement in the quality of life of the patient with obesity treated by surgery for obesity and weight-related diseases is independent from the type of performed procedure.

(Level of evidence 1, grade of recommendation A)

Two randomized clinical trials investigated the correlation between a specific type of procedure and the extent of the benefits on HRQL [392, 393]. In a study, LAGB and GBP are compared [392]. In another study, GBP and BPD were compared [393]. In both studies, while registering statistically significant differences between the two procedures regarding weight loss, the degree of improvement of quality of life was very similar. These results are corroborated by similar data reported in a recent non-randomized trial that compared the four most frequently performed procedures (GBP, SG, LAGB, and BPD) [394].

Statement 4.1.3
In long-term follow-up after surgery for obesity and weight-related diseases, the quality of life follows the trend of body weight. The quality of life remains satisfactory provided the percentage of excess weight loss (%EWL) is maintained above 10 %.

(Level of evidence 1, grade of recommendation B)

At present, there are two published studies that analyze the changes of quality of life of the patient with obesity undergoing surgery for obesity and weight-related diseases. At a median follow-up of 6 [391] and 10 years, respectively [380], the results obtained appear similar. The different aspects of HRQL significantly and rapidly improve in the first 12–24 months after the surgical procedure, and then gradually worsen, likely due to weight regain. In the SOS, there is, between 6 and 10 years after surgery, a substantial stabilization of the quality of life of the patient that is still satisfactory compared to the preoperative condition [380].

Sub-chapter 4.2 Adolescents

Statement 4.2.1

Surgery for obesity and weight-related diseases is effective in patients with obesity who are under 18 years of age

(Level of evidence 2, grade of recommendation B)

In the absence of changes of lifestyle, children with obesity may suffer a reduction of life expectancy between 10 and 20 years and are at risk to develop serious health problems between 40 and 60 years of age. Studies show that without proper treatment, children with extreme obesity may continue to suffer from obesity in adulthood, and that overweight adolescents have a 70 % chance of becoming adults with obesity or overweight [395].

In addition, two thirds of children with morbid obesity have two or more cardiovascular risk factors and a significant proportion of these children suffer comorbidities that are usually seen in adults. Obesity is a risk factor for cardiovascular diseases such as hypertension, dyslipidemia, left ventricular hypertrophy, and atherosclerosis. A study that included adolescents aged 5 to 17 years, demonstrated that 70 % of children with obesity had at least one cardiovascular risk factor and that 39 % of children suffering from obesity had at least two risk factors. The incidence of type 2 diabetes has increased dramatically among adolescents in this study, representing a fifth of newly diagnosed cases of type 2 diabetes. At this point diagnostic criteria for MSy are already present for adolescents aged more than years of age or greater who present at a greater than 90th percentile on their waist circumference [396].

Obesity in youngsters is also associated with liver disease, particularly steatohepatitis with fibrosis and eventually cirrhosis progression. In addition, the negative impact on the psychologic health, notoriously important to the emotional development, cannot be overstated. In this context, the incidence of depression, low self-esteem and poor interaction with peers, anxiety, suicide, and serious psychosocial problems increases with increased weight [397]. From a neurological point of view, obesity is associated with IIH or pseudotumor cerebri (see sub-chapter 3–10). Children suffering from obesity have a six times higher incidence of obstructive sleep apnea than children of normal BMI.

In general, children and adolescents with obesity should be evaluated, followed, and treated by endocrinologists and pediatricians. The lifestyle of these children, their living environments, the degrees of obesity in their family histories and their neonatal or psychomotor developments should be noted. A history for a possible medication use related to the development of obesity must also be investigated. The collection of these data is important to help rule out secondary, syndromic, and monogenic causes of obesity.

In 2007, the European interdisciplinary guidelines, in agreement with the views expressed by a document from US pediatricians, supported the use of surgery for patients with obesity who are younger than 18 years of age, with some limitations. These parameters included supporting surgery for obesity and weight-related diseases only for patients whose BMI >40 kg/m^2 (or >99.5th percentile for age) with

at least one comorbidity. Patients had to have been treated medically for at least 6 months in a specialized center and demonstrated skeletal maturity and completed development (Tanner Score >4). They had to also demonstrate an ability to adhere to multidisciplinary pre- and postoperative programs and have good access to a facility with a pediatric support specialist [398].

In the face of an increased incidence of adolescent obesity, the knowledge that a teenager with obesity has a high propensity to become a severely obese adult, the growing safety and efficacy of surgery for obesity and weight-related diseases, and the increasing experience of multidisciplinary teams has triggered greater use of surgery for obesity and weight-related diseases for the adolescent suffering from obesity [387, 395, 399].

One of the main concerns when dealing with adolescents with obesity is their degree of maturity. Previous recommendations stated that the earliest age for adolescents to be considered for surgery for obesity and weight-related diseases was 13 years of age for girls and 15 years for boys. Future recommendations should support surgery for patients who have reached the 95th percentile for parental height (skeletal maturation nearly complete). Age limits should, however, also take into account the advent of puberty.

The selection criteria published by ASMBS in 2012 [400] revised and simplified the criteria published by the interdisciplinary European group in 2007 [398] and Pratt in 2009 [397].

The criteria stated that the BMI values used in adults appear to be appropriate for the selection of adolescent patients but must include additional specific parameters such as BMI >35 kg/m^2 with at least one significant comorbidity such as T2DM, moderate or severe OSAS (AHI >15 events/h), pseudotumor cerebri, severe steatohepatitis, or BMI >40 kg/m^2 with the presence of other comorbidities such as mild OSAS (AHI 5–15 events/h), high blood pressure, impaired glucose tolerance, insulin resistance, dyslipidemia, impaired quality of life, and difficulties in daily activities. It is possible that in the future, like for adults, BMI as the major criteria for determining if an adolescent with obesity can undergo surgery for obesity and weight-related diseases, will play a more minor role in the decision-making. Other factors may become more prevalent such as the multidisciplinary evaluation, psychological factors, metabolic issues, functional comorbidities, quality of life, suicide risk for adolescents, and consideration of long-term health risks in the absence of treatment in a patient who has a long life expectancy [396].

Sub-chapter 4.3 Elderly patients

Statement 4.3.1

Surgery for obesity and weight-related diseases is effective in patients with obesity who are over the age of 60 years (Level of evidence 2, grade of recommendation A)

Surgery for obesity and weight-related diseases in the elderly must pay particular attention to the cost/benefit ratio. The comorbidities are usually more common and more severe, and the operative complications are more frequent resulting in an increased mortality risk. The expected weight loss is often lower and the effects on the quantity and quality of remaining life are variable and not really quantifiable. Additionally, there is less compliance to new dietary guidelines imposed by interventions [401]. While the literature demonstrates that surgery for obesity and weight-related diseases in the elderly results in a higher percentage of postoperative complications and lower weight loss related to younger patients, there are similar improvements/resolutions of the comorbidities and improvement of functional independence and quality of life [402–404].

Taylor et al. conducted a prospective study in 40 patients with mean age 65.8 years (range 60–72) and preoperative mean BMI of 42.2 kg/m^2 treated by LAGB [405]. Mean excess weight loss at 2 years was 54 %. Three complications (7.5 %) occurred (1 slippage and 2 access-port infections). There were no deaths. After a mean postoperative interval of 27 months, SF-36 scores improved significantly in four of the eight components and exceeded the age-matched population controls in three components. Comorbidity improvement was reported in 80 % of patients with diabetes, 79 % with dyslipidemia, 75 % with obstructive sleep apnea, 72 % with heartburn, 69 % with hypertension, 60 % with musculoskeletal pain, and 56 % with anxiety/depression. Medication requirements reduced or ceased in 66 % of individuals who required musculoskeletal analgesics, 43 % of diabetics, 33 % bronchodilators used, and 29 % with hypertension. Sleep improved in 48 %, self-esteem increased in 70 %, and 72 % had a better outlook on life. Eighty-two of patients were pleased that they had undergone LAGB, and 91 % would recommend LAGB to other older people.

Dunckle-Blatter et al. retrospectively analyzed the data of 1065 patients who underwent GBP [406]. Seventy-six (7.1 %) were aged >60 years and 989 patients (92.9 %) were <60 years old. In the older group, the mean number of comorbidities was 10; 70.5 % had diabetes, and 83.6 % had hypertension. In the younger group, the mean number of comorbidities was 4.7. The mean number of preoperative medications was 10 in the older group compared with 6.0 in the younger group. The mean length of stay was 2.9 days in both groups. Postoperatively, medications were reduced by nearly 50 % in both groups. Diabetes and hypertension resolved or improved significantly in both groups. The mean percentage of excess body weight loss was lower in the older patients (54.9 % versus 60.1 %; $P = 0.09$). The 90-day operative mortality rate was 1.64 % in the older group versus 0.53 % for the younger group (P = NS). The authors concluded that the

mortality rate was acceptable in the older group, despite the greater number of comorbidities. Both diabetes and hypertension were more common in this population, with trends toward better improvement after GBP than in younger patients [406].

Most of the studies conclude that the overriding goal of surgery for obesity and weight-related diseases in patients older than 60 years is to improve the quality of life but not to expect a prolonged median survival [407, 408].

Sub-chapter 4.4 Body composition

Statement 4.4.1

Body composition and body fat distribution determine the individual risk for obesity-associated metabolic and cardiovascular disorders.

(Level of evidence 3, grade of recommendation B)

Differences in body composition and fat distribution are predictors of the individual risk to develop metabolic syndrome (e.g., T2DM, dyslipidemia, hepatic steatosis) and cardiovascular diseases [409]. Adipose tissue stored in visceral fat depots make individuals with obesity more prone to metabolic and cardiovascular complications than fat distributed subcutaneously [32]. Normal weight individuals with low subcutaneous but increased visceral fat mass have an increased cardiometabolic risk [410]. At the same time insulin-sensitive healthy patients with obesity may be protected against obesity-associated metabolic diseases [411]. In addition, it is well-known that the extent of fat loss in patients with lipodystrophies determines the severity of associated metabolic complications such as diabetes mellitus, hypertriglyceridemia, and hepatic steatosis [412]. However, there is insufficient evidence-based data to suggest how to assign a patient to a specific surgical procedure on the basis of body composition and fat distribution.

Statement 4.4.2

Reduction of subcutaneous fat mass alone (e.g., by liposuction) does not improve circulating metabolic and inflammatory parameters

(Level of evidence 3, grade of recommendation C)

It has been demonstrated that a significant reduction in subcutaneous fat mass by liposuction does not improve circulating metabolic and inflammatory parameters [413], whereas the reduction of visceral fat mass by omentectomy in addition to LAGB has significant beneficial and long-term effects on measures of glucose metabolism and insulin sensitivity in individuals with obesity [414]. These positive effects were not observed in patients with obesity undergoing omentectomy without the concomitant LAGB [415].

Statement 4.4.3

Substantial weight loss following surgery for obesity and weight-related diseases may lead to bone mass loss and, subsequently, to an increased risk of fractures.

(Level of evidence 3, grade of recommendation C)

Several studies, using dual-energy X-ray absorptiometry, have reported substantial bone loss after surgery for obesity and weight-related diseases [416, 417]. Bariatric patients have been found to be more prone to fractures when compared to the general population [418–420]. A recent analysis of the SOS has shown that women who undergo surgery for obesity and weight-related diseases are at an increased risk of developing fractures and osteoporosis long-term. The findings do not seem to apply to men who have surgery for obesity and weight-related diseases. During a follow-up of as long as 25 years, women in the study who underwent one of three bariatric procedures (LAGB, VBG, GBP) were 1.5 times more likely to suffer a fracture compared with controls and significantly more likely to develop osteoporosis. GBP, compared to LAGB and VBG (no data about SG), presented higher risk of osteoporosis [421]. It is noteworthy, that profound weight loss may cause artifactual changes in DXA areal bone mineral density results. Assessment of volumetric bone mineral density by quantitative computed tomography may be less susceptible to such artifacts [422].

Statement 4.4.4
Loss of lean body mass after surgery for obesity and weight-related diseases is substantial and strategies to limit lean body mass loss should be emphasized.
(Level of evidence: 2, grade of recommendation: B)

Reduced skeletal muscle mass is a major predictor of impaired physical function and survival [423]. It has been suggested that loss of lean body mass may be substantial after surgery for obesity and weight-related diseases [424, 425]. In a recent systematic review of the literature, the majority of reports found positive effects of exercise before and following surgery for obesity and related diseases on anthropometric parameters, cardiovascular risk factors and physical fitness [426]. In the long-term, higher physical activity and lower sedentary time is associated with greater excess weight loss and maintenance of reduced body weight following surgery for obesity and weight-related diseases [427]. Chaston et al., in a systematic review, evaluated changes in fat free mass (FFM) following significant weight loss. The authors included

in the review RCTs, clinical controlled trials, and observational studies and concluded that the percentage of weight lost as FFM in medical interventions was influenced by the level of calorie restriction, exercise, and rate of weight loss. BPD and GBP were associated with greater %FFML than LAGB [428].

Sub-chapter 4.5 Low BMI

Statement 4.5.1

Surgery for obesity and weight-related diseases is effective in patients with class I obesity (BMI 30–35 kg/m2) and comorbidity.

(Level of evidence 1, grade of recommendation A)

It has been demonstrated that patients with the same BMI can have health conditions and risk factors that fundamentally differ. On the other hand, patients with class I obesity may have similar or even worse comorbidities, compared to subjects with obesity of higher classes. Consequently, there is a need to identify parameters other than BMI to better characterize patients eligible for surgery [61].

The evidence for the good results of surgery for obesity and weight-related diseases on the metabolic control of patients with class I and class II obesity and type II diabetes have stimulated and encouraged the expansion of the indications for surgery even for patients with BMI 25–30 kg/m2. [45, 429, 430].

In 2004 and in 2005, the ASMBS and the European Association of Endoscopic Surgeons (EAES) recommended the extension of surgery for obesity and weight-related diseases to clinical trials involving patients with class I obesity in presence of a comorbidity [431, 432].

The interest in patients with class I obesity began to rise at the same time as data on the beneficial effects of surgery on diabetes control began to spread. In fact, in 2011, the International Diabetes Federation (IDF) recommended surgical treatment in patients with type 2 diabetes and class I obesity who have failed conventional therapies. The IDF also suggested that the surgeries be done within the limits of research protocols and not as the first therapeutic approach [11, 433].

In 2013, the ASMBS concluded that surgery for obesity and weight-related diseases is recommended in patients with BMI 30–35 kg/m^2 if there is an inability to maintain weight loss or improvement/ resolution of comorbidities obtained with nonsurgical therapies. In randomized controlled trials, LAGB, SG, and GBP have been shown to be safe, well tolerated, and effective in the short- and medium-term. Furthermore, it is only appropriate to proceed with surgery after an attempt at nonsurgical therapy [60].

In 2014, the IFSO created a position statement concerning surgery for patients with class I obesity. The IFSO stated that surgery for obesity and weight-related diseases is a highly effective weight loss strategy in patients with class I obesity at least in the medium-term. The adverse events rate in patients with class 1 obesity appears to be the same than in morbid obesity [61].

The overall analysis of randomized controlled trials, meta-analyses and prospective and retrospective studies have shown good results in terms of weight loss and reduction of comorbidity compared with patients who present a higher class obesity [10, 13, 45, 62–65, 429, 430, 434–437].

Conclusion

Obesity is a chronic disease that has already reached pandemic proportions and is becoming one of the leading causes of death and disability worldwide. A comprehensive, sustainable, and proactive strategy to deal with the challenges posed by the obesity epidemic is urgently needed. Weight loss induced by surgery has proven to be highly efficacious in treating obesity and its comorbidities.

Many international scientific societies and health organizations have proposed over the years position statements or guidelines related to the indications for surgical treatment for patients with obesity. These include scientific statements from the American Heart Association (AHA) in 2011, American Association of Clinical Endocrinologists (AACE) in 2011, American Diabetes Association (ADA) in 2011, International Diabetes Federation (IDF) in 2011, Bariatric Scientific Collaborative Group (IFSO, IFSO- EC, EASO, IOTF, ECOG) in 2007, U.S. Internal Revenue Service (IRS) in 2002, Centers for Medicare & Medicaid Services (CMS) in 2006, National Institutes of Health (NIH) in 1991.

This position statement takes account the major changes that have occured in recent years. On one hand, the increased interaction between the various scientific societies, and health organizations dealing with obesity, and on the other hand, the improvements in the surgical techniques that have led to a significant reduction in morbidity and operative mortality.

The interaction with other scientific societies and health organizations has led to the conclusion that the disease of obesity can no longer be identified only by weight/height ratio (BMI) or anthropometric measures but must also take into account the different clinical manifestations of functional type, metabolic type, psychological /psychiatric type and, not less important, social type. These considerations, along with the development of less aggressive surgery, have created the need to draw up the position statement with upgraded indications. This statement was created by a working group formed by prominent members of the International Federation for the Surgery of Obesity and Metabolic Disorders (IFSO) and then discussed and approved by the Executive Board of (IFSO).

Consequently, after a careful review of the available data concerning the safety and efficacy of surgery for obesity and weight-related diseases and its effectiveness in treating obesity and its comorbidities, IFSO's panel has endorsed new recommendations that consider the most modern functional, metabolic, psychological /psychiatric, and social aspect of obesity.

Compliance with Ethical Standards

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

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