



Guidelines/statements

ASMBS position statement on preoperative patient optimization before metabolic and bariatric surgery

Jonathan Carter, M.D.*, Julietta Chang, M.D., T. Javier Birriel, M.D., Fady Moustarah, M.D.,
Stephanie Sogg, Ph.D., Kasey Goodpaster, Ph.D., Sue Benson-Davies, Ph.D.,
Katie Chapmon, R.D., Dan Eisenberg, M.D.

*Clinical Issues Committee, American Society of Metabolic and Bariatric Surgeons
Department of Clinical Surgery, University of California-San Francisco, San Francisco, California*

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The following position statement is issued by the American Society for Metabolic and Bariatric Surgery in response to inquiries made to the society by patients, physicians, society members, hospitals, health insurance payors, the media, and others, regarding preoperative health optimization prior to bariatric and metabolic surgery. These recommendations are based on current clinical knowledge, expert opinion, and published peer-reviewed scientific evidence available at this time. The statement is not intended to establish a local, regional, or national standard of care. The statement will be revised in the future as additional evidence becomes available.

Preoperative optimization refers to the management of modifiable risk factors prior to elective surgery, with the goal of reducing the risk of perioperative complications and improving outcomes. In contrast to simple patient assessment, where risk factors are identified passively, preoperative optimization involves active risk mitigation, occasionally delaying surgery until a specific goal is met. Over the past decade, the number of reports of preoperative optimization in the surgical literature increased significantly, many embedded within enhanced recovery programs [1].

Bariatric surgeons have long been at the forefront of preoperative optimization. Current practice, in accordance with published guidelines, is to comprehensively evaluate patients

seeking bariatric surgery with detailed laboratory, psychosocial, nutritional, and medical assessments [2]. Here we review common preoperative optimization topics and apply them to bariatric surgical patients. For each topic, we make recommendations based upon best available evidence.

Smoking cessation

Effect of smoking on bariatric outcomes

Smoking tobacco is known to increase morbidity and mortality after bariatric surgery. Haskins et al. [3] reported 35,696 laparoscopic bariatric operations to the American College of Surgeons National Surgical Quality Improvement Plan (ACS NSQIP) and found that smoking increased the odds of prolonged intubation by 63%, re-intubation by 61%, sepsis by 44%, shock by 96%, and resulted in a longer hospital length of stay. Another analysis of NSQIP data of 33,714 laparoscopic sleeve gastrectomy patients showed that smoking within the past year was associated with 90% increased odds of serious morbidity, 23% increased odds of readmission, and an almost 5-fold odds of death within 30 days after the procedure [4]. Similar outcomes have been reported by other, but not all, investigators [5,6]. It is cigarette smoke itself, not the nicotine component per se, that is thought to be responsible for these adverse effects [7]. Cigarette smoke contains over 3,000 pharmacologically active agents, of which 250 are known to be harmful [7]. Mechanisms of injury from cigarette smoke include accelerated atherosclerosis, increased platelet aggregation, vasoconstriction,

* Correspondence: Jonathan Carter, M.D., Professor of Clinical Surgery, University of California, San Francisco, 521 Parnassus Avenue, room HSW1301, San Francisco, CA 94143.

E-mail address: jonathan.carter@ucsf.edu (J. Carter).

endothelial dysfunction, reactive oxygen species, impaired neutrophil and macrophage migration, poor fibroblast response and collagen synthesis, and poor pulmonary clearance [8]. The cumulative effect of smoking is impaired healing and increased susceptibility to infections [8].

Effect of preoperative smoking cessation interventions on surgical outcomes

A number of investigators have examined the benefits of preoperative smoking cessation programs. Since there are no reports on bariatric surgical patients specifically, we rely on evidence from general surgical and orthopedic patients. Lindström et al. [9] randomized 117 active smokers to 4 weeks of preoperative counseling and nicotine replacement versus usual care. Although the intervention achieved cessation in only 58% of patients by the day of surgery, postoperative complications were still reduced by half on intention-to-treat analysis [9]. Møller et al. [10] randomly assigned 120 patients to 6–8 weeks of preoperative cessation counseling and nicotine replacement therapy versus usual care. The overall complication rate was 18% in the smoking intervention group and 52% in controls ($P = .0003$) [10]. A Cochrane review summarized interventions for preoperative smoking cessation [11]. In this review, most studies reported on interventions that began 4–8 weeks before surgery. Intensive behavioral interventions, characterized by dedicated provider-initiated counseling and provision of nicotine replacement therapies, increased 10-fold the rate of smoking cessation before surgery (relative risk [RR]: 10.76; 95% CI: 4.55–25.46), reduced complications by 60% (RR: .42; 95% CI: .27–.65), and increased 3-fold the 1-year rate of smoking cessation (RR: 2.96; 95% CI: 1.57–5.55) [11]. On the other hand, brief interventions, such as a recommendation to quit without follow-up, had only a mild effect on smoking cessation before surgery (RR: 1.30; 95% CI: 1.16–1.46) and did not reduce complications overall (RR: .92; 95% CI: .72–1.19) [11]. Such improvement in surgical outcomes with 4–8 weeks of smoking cessation can be explained by findings that many impairments of wound healing and inflammation are reversible, after smoking cessation. By 4 weeks, platelet aggregation has improved, endothelial progenitor cells are restored, neutrophil and macrophage function is improved, and airway inflammation is lessened [8].

Safety of nicotine replacement therapy

Nicotine replacement therapy includes gum, lozenges, patches, nasal spray, and inhalers. It was introduced in the United States in the early 1990s and has an excellent safety profile, with large-scale placebo-controlled trials showing no increase in adverse events [12,13]. Nicotine replacement improves the success rates of smoking cessation programs by 60% [14,15]. Although the effects of nicotine specifically on bariatric outcomes have never been reported, clinical

evidence in humans has generally shown surgical outcomes of patients on nicotine replacement to be similar to abstinence [14]. There is no evidence that nicotine replacement increases the risk of healing-related or cardiovascular complications [14]. With regard to other options, there is no evidence to support the safety of e-cigarettes (i.e., vaping) as a form of nicotine replacement [16]. Indeed, evidence is accumulating that vaping is harmful [17]. There are no trials of pharmacologic agents (i.e., bupropion, varenicline, or amitriptyline) for preoperative smoking cessation [18].

Verification of smoking cessation

Patients seeking bariatric surgery may underreport their smoking habits to physicians. Gormsen et al. reported on 71 bariatric patients, of whom 17% were active smokers and 35% were previous smokers, who underwent 3 months of preoperative smoking cessation counseling under threat of surgical cancellation [19]. Despite the threat of cancellation, 13% of patients presented on the day of surgery with a positive cotinine test [19]. For patients transitioned to nicotine replacement therapy, smoking cessation cannot be verified with cotinine testing because all forms of cotinine testing will stay positive for up to 7 days after cessation of either nicotine replacement therapy or smoking [20]. Thus, nicotine replacement may complicate preoperative nicotine detection in centers that use cotinine-based testing to enforce a no-smoking policy. The only other way to test for tobacco use specifically is to use carbon monoxide testing, which is detectable for only 24 hours after the last cigarette and may have other confounders [20].

Patients who smoke tobacco are at high risk for preoperative program dropout and may require extra support during their preoperative bariatric evaluations. Veldheer et al. [21] studied smokers referred for bariatric surgery who underwent regular cessation counseling, referral to a national smoking cessation hotline, referral to a primary care physician for bupropion or varenicline if interested, and mandatory abstinence before surgery, validated by serum cotinine testing. Tobacco users dropped out of the preoperative bariatric program at almost twice the rate of nontobacco users [21].

Long-term outcomes after bariatric surgery

The majority of surgical patients who smoke tobacco will return to smoking within 6–24 months after surgery [22–24]. Lee reported 1-year outcomes of a preoperative smoking cessation program that included brief counseling by a nurse, smoking cessation brochures, referral to a telephone quit line, and a free 6-week supply of transdermal nicotine replacement therapy [22]. At 1 year, only 25% maintained smoking cessation, compared with just 8% of controls [22]. This high rate of return-to-smoking has also been described elsewhere [23]. Since smoking is a major risk factor for marginal ulceration after gastric bypass, and since

return-to-smoking is so common, many surgeons believe bypass should probably be avoided in patients who report smoking within the last year [24]. With regard to weight loss outcomes, available data show tobacco smoking has minimal effect [25].

Marijuana smoking

Marijuana is used by almost 10% of the American population and has been legalized in many states for either medicinal or recreational use [26]. Interestingly, population studies have shown that as body mass index (BMI) increases, the prevalence of marijuana use actually decreases [27]. Marijuana is generally smoked without filters and is known to contain more tar, irritants, and carcinogens than tobacco smoke [26,28]. As a result, 3–4 cannabis cigarettes are the equivalent of 20 tobacco cigarettes in terms of airway irritation and bronchial damage [26,28]. Cannabinoids can cause tachycardia, hypertension, and arrhythmias [26,28]. They also increase the risk of myocardial infarction and stroke, partly from these hemodynamic effects, but also in part because cannabinoids influence coagulation by interfering with adenosine diphosphate-induced platelet aggregation [26,28]. As a result, there is concern about increased risk of thromboembolic events with cannabinoid use. Cannabinoids can induce cross-tolerance to barbiturates, opioids, benzodiazepines, and propofol, such that higher doses are needed to achieve the same effect [26]. For example, after surgery, patients who use cannabinoids have been shown to require more opiates, while paradoxically reporting lower pain scores [29].

Patients who use cannabinoids and undergo weight loss surgery are more likely to report loss-of-control over food intake, and 1 study reported that 1 in 5 will increase cannabinoid consumption after surgery despite recommendations against it [30]. How cannabinoids affect weight loss after bariatric surgery remains an open question; one study reported no difference in weight loss compared with nonusers in the first 90 days after surgery [29]. Another study reported no differences in complication rates or weight loss in the first 2 years after bariatric surgery compared with nonusers [31]. Taken as a whole, these reports indicate that marijuana use may not significantly affect postoperative weight loss.

Overall, the medical literature describing clinical effects of marijuana is nascent; further investigation is needed before guidelines can be established. Since many of the concerns are related to inhalation of combusted marijuana smoke, one approach taken by some surgeons has been to preoperatively convert marijuana users to an ingested form (such as a tincture that can be taken under the tongue), using a varietal that minimizes loss-of-control eating, although no literature exists with regard to the efficacy of this approach. Finally, surgeons should be aware of the cannabinoid hyperemesis syndrome, a condition characterized by recurrent

nausea, vomiting, and cramping abdominal pain due to cannabis use [32]. Patients often self-treat this by taking a hot shower or bath, which improves symptoms. Treatment is marijuana cessation.

Recommendations for smoking cessation before bariatric surgery

- Patients seeking bariatric surgery should stop smoking tobacco.
- For patients who report smoking tobacco within the last year, referral to a primary provider or smoking cessation program should be initiated early, such that smoking cessation is completed at least 6 weeks prior to date of surgery.
- Nicotine replacement therapy is safe and efficacious for use in preoperative smoking cessation programs. There are no data to support or refute other pharmacologic agents (i.e., bupropion, varenicline, or amitriptyline) as an alternative to nicotine replacement therapy in the preoperative setting as a means to improve surgical outcomes.
- There is growing evidence that vaping/e-cigarettes is harmful.
- Long-term relapse of smoking is to be expected.
- Patients should be screened for marijuana use. Patients who smoke marijuana should be encouraged to quit.

Preoperative glycemic control

Between 20%–40% of patients who seek bariatric surgery have been diagnosed with type 2 diabetes (T2D) [33]. Chronic hyperglycemia causes glycation of hemoglobin which can be measured by the hemoglobin A1C (HbA1C), which reflects the mean serum glucose level for the previous 120 days and is now part of the diagnostic criteria for T2D [34]. The American Diabetic Association uses A1C levels of 5.7%–6.4% as one criterion for diagnosing prediabetes, and >6.5% for diabetes. For most patients with diabetes, guidelines call for a goal of A1C <7% (<6.5% for patients without concurrent serious illness and at low hypoglycemic risk) using a combination of lifestyle modification, pharmacotherapy, or surgery [35]. Current guidelines are to obtain both A1C and a fasting blood glucose as part of the preoperative bariatric evaluation [2]. Patients diagnosed with diabetes or prediabetes should be evaluated and treated with an individualized care plan, to include a healthy low-calorie diet, medical nutrition therapy, physical activity, or pharmacotherapy, in accordance with American Association of Clinical Endocrinology (AACE) guidelines [35].

Glycemic control as a predictor of adverse perioperative events in noncardiac surgery

A number of investigators have examined preoperative A1C as a predictor of adverse outcome after noncardiac surgery, with conflicting results. Dronge et al. [36] studied a cohort of 647 patients with diabetes who underwent major noncardiac surgery and found that A1C >7% was associated with increased risk of infectious complications (odds ratio [OR] 2.3, 95% CI: 1.23–3.70, $P = .007$). Goodenough et al. [37] studied a cohort of 438 patients who underwent abdominal surgery with A1C drawn preoperatively, and examined risk of serious (e.g., Clavien-Dindo grade 3+) complications. In multivariate models, A1C >6.5% predicted serious complications (OR 2.32, 95% CI: 1.11–4.82, $P = .03$), whereas perioperative glucose concentrations, and a clinical diagnosis of diabetes, did not. Finally, Underwood et al. [38] studied 622 noncardiac surgical patients with A1C obtained preoperatively and compared them with a control group of patients without diabetes matched by age, sex, and BMI. In multivariate regression, higher A1C was associated with increased hospital length of stay, but not mortality, infections, or readmissions. In these studies, the quality of glycemic control as expressed by an elevated A1C, was associated with adverse outcomes.

In contrast, other investigators have found A1C not to be predictive of adverse events after noncardiac surgery. Jones et al. [39] conducted an observational cohort study of 21,541 patients who underwent gastrointestinal surgery and examined the relation between preoperative A1C, postoperative peak glucose levels, and readmissions. Interestingly, A1C >6.5% was associated with decreased odds of readmission, whereas peak postoperative glucose >250mg/dL was associated with increased odds of readmission (OR 1.20; 95% CI: 1.01–1.4). This may be explained by the observation that elevated A1C was associated with more perioperative insulin and glucose checks, indicating greater vigilance in treating postoperative hyperglycemia. King et al. [40] reviewed 55,408 patients with diabetes who underwent noncardiac surgery and found that preoperative A1C did not affect postoperative infection rates, whereas postoperative peak serum glucose did. These studies highlight the idea that the important predictor of complications is glycemic control in the early postoperative period, irrespective of the degree of preoperative glycemic control as measured by A1C [41].

Several comprehensive reviews have examined the impact of preoperative A1C levels on mortality, changes in management, and complications in noncardiac surgery [42,43]. In one systematic review, Bock et al. [42] concluded that no data derived from high quality studies support the effectiveness of routine testing for preoperative blood glucose concentration and A1C in otherwise healthy adult patients undergoing elective, noncardiac surgery. Rollins et al. [43], in a systematic review of 20 studies including

19,514 patients with diabetes who underwent a broad range of operations, found that preoperative glycemic control did not affect the incidence of stroke, venous thromboembolic disease, hospital readmission, intensive care unit (ICU) length of stay, or 30-day mortality. Additionally, the majority of studies suggested no link between A1C and acute kidney injury, need for postoperative dialysis, dysrhythmia, infection not related to the surgical site, or total hospital length of stay. The literature was highly variable with regards to myocardial events, surgical site infection and reoperation rates [43].

Glycemic control as a predictor of adverse events after bariatric surgery

There are several reports in the bariatric literature with regard to preoperative glycemic control as a predictor of complications. Perna et al. [44] studied 468 patients who underwent gastric bypass, stratified by preoperative A1C. In univariate analysis, A1C >8% was associated with increased incidence of wound infection and acute renal failure, but in multivariate analysis, A1C dropped out, and only the mean postoperative glucose levels remained predictive of complications. In turn, A1C predicted postoperative hyperglycemia. Similarly, Rawlins et al. [45] studied 342 patients with diabetes who underwent gastric bypass, stratified by preoperative A1C. No differences in complications were observed when A1C was >7%. Wysocki et al. [46] studied 1718 laparoscopic sleeve gastrectomy patients stratified by A1C. The complication rate was 6.2% and did not vary across preoperative A1C values, nor did A1C predict length of stay. An A1C >7.3% was associated with a higher risk of readmission [46]. In abstract form, Lamb et al. [47] reported on 61,027 patients who undergone laparoscopic gastric bypass or sleeve in the Metabolic and Bariatric Surgery Accreditation and Quality Improvement Program (MBSAQIP) database. There was no association between preoperative A1C and 30-day complication rates for either operation. Finally, Basishvili et al. [48] reported on 117,644 patients who underwent either sleeve or bypass reported in MBSAQIP and found that A1C was not associated with overall complications, including 30-day readmissions, reoperations, reinterventions, or death, at any A1C cutoff. In summary, published reports in the bariatric literature failed to demonstrate an association between preoperative A1C and adverse outcomes.

Glycemic control as a predictor of longer-term bariatric outcomes

Several investigators have examined the relationship of preoperative glycemic control and longer-term outcomes, with mixed results. English et al. [49] reported on 245 patients with diabetes who underwent 6 months of intensive lifestyle modification and medication with a goal to achieve A1C <7% before gastric bypass. Patients who achieved a

1% decrease in A1C were 68% more likely to achieve diabetes remission at 1 year after surgery. Similarly, de Oliveira et al. [50] demonstrated that patients with A1C <7% were more likely to achieve postoperative diabetes remission than those with higher A1C (OR 2.43, $P = .017$, versus A1C >10%). On the other hand, Chuah et al. [51] randomized 35 patients with A1C >8.5% and planned gastric bypass in a pilot study to undergo intensive glucose control preoperatively, with a goal to decrease A1C by at least 1%, versus usual care. In the intensive arm of the trial, mean A1C decreased from 9.9% to 8.4% ($P = .003$), whereas in the usual care group, there was no significant change (A1C went from 10.3% to 9.7%, P value was nonsignificant). Although the study is admittedly underpowered, the authors found no differences in surgical complications or A1C values 1 year after surgery between groups [51].

Recommendations for glycemic control before bariatric surgery

- Bariatric surgery patients should receive a preoperative hemoglobin A1C and fasting blood glucose as a screen for diabetes and prediabetes, so they can be managed perioperatively in accordance with ACE guidelines.
- Current evidence does not support delaying or withholding bariatric surgery until a specific A1C target is reached. In patients with elevated A1C, avoidance of early postoperative hyperglycemia may improve outcomes.

Preoperative nutrition assessment

Medical nutrition therapy by a registered dietitian is the foundation of long-term success following metabolic and bariatric surgery [52,53]. Individual physiological responses to surgery can vary, based on the alterations of gut hormones, malabsorption processes, caloric restriction, and microbiota [54]. Additionally, an individual's weight loss depends on genetic variations, epigenetics, and gene expression in response to environmental factors, including nutrition [54,55]. Thus, personalized nutrition before and after surgery is essential for long-term weight loss success [55].

Effect of medical nutrition therapy on bariatric outcomes

Medical nutrition therapy improves bariatric outcomes. Andromalos et al. [53] reported that increased frequency of medical nutrition therapy visits by a registered dietitian were associated with greater weight loss than less nutrition follow-up care. Calleja-Fernández et al. [56] reported medical nutrition therapy was associated with more protein

intake, which in turn resulted in better preservation of lean body mass after biliopancreatic diversion and duodenal switch than no nutrition therapy. In a randomized study, Sarwer et al. [57] demonstrated medical nutrition therapy improved cognitive restraint, increased protein intake, and reduced the mean consumption of calories, sweets, and fats compared with standard care. Swenson et al. [58] demonstrated that medical nutrition therapy increased the time spent per week participating in physical activity. In summary, medical nutrition therapy is a framework for preoperative and postoperative behavior change and improves weight loss outcomes [53].

Critical components of a preoperative bariatric nutrition evaluation

While most patients seeking bariatric surgery do not have genetic abnormalities that contribute to obesity, epigenetics and environmental factors (poor nutrition, lack of physical activity, sleep disruption, medications, stress) have been associated with increased adiposity and obesity-related comorbidities. Eating behaviors, lifestyle habits, psychosocial factors, anthropometrics, metabolism, biochemical, and nutritional analysis should be used to create a comprehensive and personalized nutrition plan [52–54,59–62]. The critical elements of the preoperative nutrition assessment follow below.

Weight history and eating behaviors

A patient's nutritional evaluation should be done by a registered dietitian and include a chronologic weight history and a review of eating behaviors, dieting attempts, and any life-changing circumstances associated with weight change [63]. Sogg et al. [62] reported that up to 50% of patients seeking bariatric surgery have reported binge eating symptoms, night eating, and other maladaptive eating behaviors. Lynch et al. [64] identified 4 specific patterns of weight change over time: always heavy, late peak, steady progression, and weight cycling. Life events, times of transition, and stressors were also critical triggers of weight gain over time. Careful evaluation of weight history with dieting attempts and eating behaviors is a valuable source of information for formulating cognitive behavioral nutrition intervention [53,59].

Medical history and medication review

Medications potentially associated with weight gain or increased appetite include hypertension medications, diabetes medications, hormone therapies, anti-seizure medications, antidepressants, mood stabilizers, antipsychotics, migraine medications, and anti-inflammatory agents [65]. Nutritional and herbal supplementation should be reviewed to assess therapeutic risks and benefits [65]. When a medication associated with weight gain is

identified, referral back to the prescribing physician to consider alternatives is appropriate. For patients undergoing revision or conversion surgery, any symptoms of discomfort, nausea, vomiting, dysphagia, food textures, hydration, appetite, weight, or neurologic changes should be documented and addressed [61].

Body composition and energy requirements

If available, body composition analysis and resting energy expenditure provides a baseline for adiposity distribution, fat mass ratios, android fat, gynoid fat, visceral fat, percent body fat, lean mass, bone mineral density, and resting metabolic rate [66]. Body composition performed by dual energy x-ray absorptiometry provides an in-depth and accurate analysis of body morphology [65]. Resting metabolic rate is measured via indirect calorimetry [66]. Changes in fat mass, fat-free mass, and metabolic rate over time can be used to calculate the degree of adaptive thermogenesis or metabolic adaptation after surgery [60,66,67]. Repeated metabolic rate measurements after surgery may aid in prescribing caloric requirements for long-term weight maintenance [54,60,66,67].

Nutritional status

In addition to the routine biochemical analysis, dietary assessment, a nutrition-focused physical exam, and specific bariatric micronutrients (thiamin, vitamins B12, A, E, D, K, folate, iron studies, ferritin, calcium) should be assessed [2,52]. Iron deficiency in individuals with obesity may be underestimated by the measurement of ferritin alone in preoperative patients; and individuals seeking bariatric surgery should be specifically screened [68]. Similarly, zinc and copper status should be assessed before gastric bypass or duodenal switch procedures [52]. According to Parrott et al. [52], most bariatric surgery candidates present with at least 1 preexisting micronutrient deficiency. Identifying preoperative nutritional deficiencies allows time to investigate the underlying source or cause of nutrient inadequacies and provides opportunity and time for replacement therapy [52].

Recommendations for preoperative nutrition optimization

- Patients seeking bariatric surgery should be evaluated by a registered dietitian. The assessment should include a weight history, review of eating behaviors, medication review, physical exam, and assessment of micronutrients, in order to support the patient before and after surgery.

Role of preoperative weight loss in reducing body fat and liver volume

The primary rationale for weight loss just prior to surgery is to improve the technical ease of surgery by decreasing liver volume and overall adiposity, resulting in improved surgical outcomes. Such diets typically occur 2–12 weeks prior to surgery and should not be confused with insurance-mandated preoperative diets which typically require that a patient “fail” a 6- or 12-month supervised diet or maintain less than 10% weight loss during a mandated time period before bariatric surgery will be authorized. Such insurance-mandated diets have been extensively reviewed and found to have little value [69].

Metabolic improvements and reduction of body fat

Short-term preoperative weight loss can reduce glycosylated hemoglobin and allow for a reduction of diabetes medication and insulin before surgery [70–72]. Such reductions can be predictive of diabetes resolution after surgery. Biro et al. [73] showed 39 patients with diabetes who were on insulin and who were able to reduce their insulin use by half during a preoperative 14-day low calorie diet (LCD) had greater weight loss 1 year after gastric bypass, and much higher rates of diabetes remission, 72.7% versus 5.9%. Another benefit of the preoperative weight loss is a reduction of neck circumference, which can lessen the severity of obstructive sleep apnea and decrease the difficulty of intubation [71,72,74,75]. Changes in body composition due to preoperative weight loss show a decrease in both fat mass and fat-free mass [65]. Although a few studies observed higher loss of fat-free mass versus fat mass during caloric restriction [76,77], more demonstrate decrease in fat mass greater than fat-free mass [70,71,78–82].

Reduction of liver volume

The primary goal of reducing liver volume or size is to provide better exposure of the stomach and to potentially avoid conversion to laparotomy [76]. Most studies report a 15%–30% reduction in liver volume after patients followed a short-term (2–12 wk) caloric restriction of less than 1200 calories per day [71,72,77,80,83]. Colles et al. [84] showed liver volumes decreased by 30% in 9 patients over a 12-week very-low calorie diet (VLCD), but 80% of that reduction occurred in the first two weeks. Edholm et al. [78] observed an 18% decrease in liver volume in 15 patients after 2 weeks in patients who consumed an LCD; no further reduction was reported by day 28. According to a study by Edholm et al. [79] measuring liver volume by magnetic resonance imaging, a reduction of 12% may improve technical difficulty by exposure of the hiatus intraoperatively and decreased perceived difficulty by the surgeon.

Not all studies have shown benefit for preoperative weight loss. In a systematic review by Holderbaum et al. [85], there was no association between liver volume and preoperative caloric restriction. Similarly, Gils Contreras et al. [86] reported no reduction in liver volume preoperatively when participants consumed caloric restrictive diets.

Preoperative weight loss and surgical outcomes

The impact of short-term (2–12 wk) preoperative weight loss on surgical outcomes is mixed. Several studies have demonstrated decreased hospital length of stay [87–89], decreased mean operating time [89], and lower 30-day complication rates [90]. In contrast, other studies report no reductions in complication rates associated with preoperative weight loss, or more specifically, VLCDs, and low-carbohydrate diets (LCDs) [85,87,89,90]. There is also conflicting evidence regarding preoperative weight loss on postoperative weight loss outcomes. While Still et al. [88] showed preoperative weight loss to be predictive of future weight loss, others reported similar postoperative weight loss trajectories in diet and control groups [90,91]. Based on best available evidence, the ASMBS took the position in 2016 that there was no evidence that preoperative weight loss had any impact on postoperative outcomes [2].

Optimal composition and duration of the preoperative diet

Published protocols of VLCDs (400–800 kcals/d) and LCDs (800–1200 kcals/d) before surgery usually emphasize different compositions of macronutrients [70,71,74,76,83,84,85,91,92]. Meal patterns range from liquid meal replacements to food-based protocols. Baldry et al. [93] compared with 800kcal/d food-based diet to a meal-replacement diet in 54 patients and found no difference in preoperative weight loss, hepatic steatosis, or technical difficulty. Contreras et al. [86] studied 86 patients undergoing bariatric surgery and compared an 800 kcal/d VLCD shake diet with a 1200 kcal/d diet that combined shakes with food. The VLCD group had greater weight loss and similar patient-reported adherence. However, the VLCD group reported more side effects including dizziness, fatigue, and weakness. In summary, there appears to be a wide variety of dietary approaches than can be successful in the immediate preoperative period to induce sufficient weight loss for both body fat and liver volume reduction.

Adverse effects and adherence

Nonadherence during the diet period range from 4%–40% because of hunger, side effects, or taste intolerance [72,81,84,89,90]. Adverse effects from commercial weight loss products include taste intolerance, nausea, vomiting, constipation, and diarrhea [75,81,84]. Comparing VLCD

with LCD, intolerance and adverse effects are reportedly higher with VLCD [72,81,84,86,89,90]. Additionally, taste acceptability decreases over time [84]. Therefore, preoperative weight loss protocols should include a variety of dietary approaches with combinations of food-based plans and commercial products to achieve diet adherence and to reduce undesired adverse effects.

Recommendations for preoperative weight loss to reduce body fat and liver size

- Insurance-mandated weight loss has not been shown to offer benefit to patients undergoing bariatric surgery.
- A variety of dietary approaches for consumption of fewer than 1200 kcal/day are described ranging from 2–12 weeks before surgery, with a goal of visceral body fat and liver size reduction. Reductions in liver volume have been demonstrated even with shorter (2-week) courses.
- Because preoperative weight loss and adherence are not strongly correlated to postoperative weight loss and long-term outcome, inability to lose weight with a preoperative diet should not preclude bariatric surgery.

Preoperative medical screening

The ASMBS recommends patients seeking bariatric surgery to establish primary care and see their primary care physician as a part of their preoperative bariatric evaluation. Recommendations specific to primary care in patients seeking bariatric surgery are described below.

Dyslipidemia

Dyslipidemia is present in 40% of patients with obesity [94]. Adipose tissue is not inert; it is an endocrine organ. In patients with obesity, “dysfunctional fat,” or adiposopathy, results in disturbances in adipokine secretion, contributes to dyslipidemia, and increases cardiovascular risk [95,96].

Bariatric surgery has a powerful beneficial effect on dyslipidemia. A systematic review of 75 studies examined the effect of gastric bypass on lipid levels, and found a reduction in total cholesterol, low-density lipoprotein (LDL) cholesterol, and triglyceride levels up to 4 years postoperatively with an increase in HDL cholesterol levels [94]. Improvement in dyslipidemia after bariatric surgery translates to reduced cardiovascular risk [97]. One study estimated cardiovascular risk in patients before and after gastric bypass using the Framingham cardiovascular risk score and showed the relative risk reduction at 5 years postoperatively was about 25%

[98]. A meta-analysis found that type of bariatric surgery predicted the degree of improvement of dyslipidemia, with gastric bypass and biliopancreatic diversion having more effect than sleeve gastrectomy or gastric banding [99].

Patients seeking bariatric surgery should be screened with a lipid panel and treated according to society guidelines such as those from the AACE (available online at <https://www.aace.com/disease-state-resources/lipids-and-cv-health/guidelines>) [100]. Because bariatric surgery results in both weight loss and improvement in dyslipidemia, a recent society guideline, jointly released by the ASMBS and the National Lipid Association, recommends surgery as potential therapy for dyslipidemia [96].

Gout

Gout is more common in individuals with obesity owing to increased urate production, decreased renal clearance, or both. After surgery, the risk of a gouty attack is increased; one series reported an attack rate of 33.3% within 6 months after gastric bypass. The mechanism behind gouty attacks in the postoperative period is unclear. Stress from the surgery itself, or ensuing catabolic state, can cause an attack, because weight loss associated with bariatric surgery has been shown to precipitate attacks at a higher rate than other abdominal surgeries [101]. Additionally, a systematic review demonstrated higher levels of serum uric acid in the immediate postoperative period, another contributor to attacks. After significant weight loss, serum uric acid levels decrease, with decreased risk of gouty attacks [102]. Given the high rate of attacks postoperatively, prophylaxis may be warranted in patients with a history of gout [103].

Cancer screening

Obesity increases the risk of malignancies of the esophagus, stomach, colon, breast, ovary, endometrium, and prostate [104–107]. Cancer-related mortality is also higher in patients with obesity [108]. The pathophysiology of increased risk has not been fully elucidated but is likely due to visceral fat leading to increased proinflammatory markers, growth factors (including insulin), and locally synthesized estrogens and androgens [104,105]. Weight loss after bariatric surgery decreases the risk of cancer death [109].

Occasionally, a patient seeking bariatric surgery is found to have occult malignancy discovered during their preoperative assessment. One study reported that 4 of 1566 patients (.26%) were found to have either colorectal or breast cancer during preoperative bariatric surgery evaluation [109]. Given the increased risk of cancers in patients with obesity, preoperative patients should undergo age-appropriate cancer screening, such as those recommended

by the American Cancer Society (www.cancer.org) and the ASMBS [107].

Hypothyroidism

Hypothyroidism can lead to weight gain as well as a host of other symptoms [108]. Conversely, patients with obesity often have elevated thyroid stimulating hormone (TSH) levels, despite being euthyroid. This was demonstrated in a large study of euthyroid individuals that found that increased BMI was associated with an increase in both TSH and free T3, but not in free T4 levels [110]. A study of patients seeking bariatric surgery specifically, found a correlation between preoperative TSH and BMI, but not free T4. As weight loss occurred postoperatively, TSH levels decreased from 4.5 to 1.9 uU/mL [111].

For patients with true hypothyroidism, initiation of thyroid hormone replacement generally induces modest weight loss that is not sustained [112]. Given that TSH is elevated in euthyroid patients with obesity, screening for thyroid dysfunction is indicated only when there are other symptoms of hypothyroidism and is not recommended for asymptomatic patients [2].

Recommendations for preoperative medical screening

- Patients seeking bariatric surgery are encouraged to establish primary care and visit their primary care physician as part of their preoperative bariatric evaluation.
- A fasting lipid panel should be considered preoperatively; patients with dyslipidemia should be treated according to society guidelines.
- Bariatric surgery and subsequent weight loss can precipitate gouty attacks in susceptible patients; prophylaxis could be considered in these patients.
- Patients are encouraged to have age-appropriate cancer screening.
- Screening TSH is not recommended in the absence of other symptoms of hypothyroidism.

Estrogen therapy cessation

The rate of venous thromboembolism (VTE) after bariatric surgery has been reported to be <.5% [113]. Even with this low rate, VTE is a major cause of morbidity and mortality after bariatric surgery. Increase in weight or BMI has been linked to increased VTE risk, with a 37% increased risk for every 10 units increase of BMI [114].

Oral contraception increases VTE risk. The combined effect of obesity (BMI >30 kg/m²) with oral contraception use has been shown to carry a 24-fold increased risk of VTE (OR 23.78; 95% CI: 13.35–42.34) compared with normal weight (BMI <25 kg/m²) women not using oral contraception [115]. The estrogen component of oral contraception is responsible for most of the risk. Estrogen has a procoagulant effect, caused by increased fibrinogen and coagulation factors and a decrease in coagulation inhibitors. Progestins are less associated with thrombosis, but newer-generation progestins such as desogestrel, gestodene, cyproterone, and drospirenone are associated with decreased levels of antithrombin and higher coagulation factors in comparison to second generation progestins [116]. In general, progestin-only contraceptive methods have not been found to have the procoagulant side effects without the estrogen component. These methods include implants, depot injection, progestin-only pill, or an intrauterine system or device. Given the combined VTE risk of obesity and combined hormonal contraception, progestin-only contraceptives are recommended as the first-line contraceptive choice to women with BMI ≥30 kg/m² [117].

Hormonal replacement therapy also increases VTE risk. In a randomized control trial, Cushman et al. [118] found that the use of hormonal replacement doubled the risk of venous thrombosis versus placebo (hazard ratio [HR] 2.06; 95% CI: 1.57–2.70). Age was also an important factor. The use of hormonal replacement in women aged 60–69 years increased VTE risk 4-fold (HR 4.28; 95% CI: 2.38–7.72), and women aged 70–79 years 7-fold (HR 7.46; 95% CI: 4.32–14.38) versus women aged 50–59 years taking placebo. Obesity also contributed to risk. Women who were overweight on hormonal replacement had a 4-fold risk of VTE (HR 3.80; 95% CI: 2.08–6.94), and women with obesity had a 5-fold risk (HR 5.61; 95% CI: 3.12–10.11) [118,119].

Based on the known risks reported in the literature, national and international societies have provided perioperative recommendations. The British Faculty of Sexual & Reproductive Healthcare recommend “women using [oral contraceptives] who are planning to undergo bariatric surgery should discontinue use at least 1 month before surgery to reduce the risk of postoperative thromboembolism. A nonoral progestogen-only contraceptive or the Cu-IUD should be offered as an alternative. In general, progestogen-only contraceptives are considered more appropriate in women with obesity than combined hormonal methods, especially in the context of surgery” [119]. The AACE, the Obesity Society, and the ASMBS recommend “preoperative discontinuation of estrogen medications (1 cycle of oral contraceptives and 3 wk for hormone replacement therapy) since these may increase the risk of VTE. There still remains insufficient evidence to recommend timing of resumption of therapy after surgery” [2].

Recommendations for estrogen therapy cessation before bariatric surgery

- Bariatric surgical candidates should be counseled on the risk of VTE associated with the use of estrogen-containing hormonal contraception or hormone replacement therapy. Alternative contraception strategies include progestin-only contraceptives or non-hormonal intrauterine devices.
- Patients should consider cessation of estrogen-containing oral contraceptives for 1 month, and hormonal replacement therapy for 3 weeks, before bariatric surgery.

Preoperative cardiac risk assessment

Benefits of bariatric surgery to cardiovascular health

The ability of bariatric surgery to slow the progression of cardiovascular disease and improve cardiac health, with notable reductions in major cardiovascular adverse events after surgery in long-term observational studies, has been well-described [97,120–128]. T2D and lipid profiles show clear and independent improvement after weight loss surgery [94,97,99]. Vogel et al. [129] reported that bariatric surgery decreases coronary heart disease risk to rates lower than the age and gender-adjusted estimates for the general population. Bariatric surgery provides beneficial cardiac effects on diastolic function, systolic function, and myocardial structure [130].

With such strong cardiovascular benefits, bariatric surgery should be considered an option even in patients with significant cardiac disease. Bariatric surgery has very low risk of mortality and perioperative myocardial infarction, setting it apart from other low-risk general surgical procedures [131,132]. A recent review by Gondal et al. [133] of more than 172,000 patients showed that the 30-day rate of myocardial infarction was .03%. Despite the expected high prevalence of cardiovascular risk factors in this population, the very low rate of myocardial infarction was attributed to modern operative techniques and follow-up. Recently, in a study of 1330 patients, Blanco et al. [132] demonstrated that high-cardiovascular-risk patients may benefit from improvements in their calculated 10-year Framingham risk scores more than low-risk patients after gastric bypass or sleeve gastrectomy. Other studies confirm this improvement by showing a decreased prescription medication use after surgery and improvement in overall health status [134]. Bariatric surgery has also been used as a bridge to transplantation in heart failure patients [135].

Preoperative cardiac risk assessment methods

There are no cardiac risk-assessment protocols specific to bariatric surgery. As such, we recommend adherence to the latest recommendations from the American College of Cardiology (ACC) and the American Heart Association (AHA) [136]. Risk factors for major adverse cardiovascular events should be assessed using a validated risk calculator, such as the Revised Cardiac Risk Index (RCRI) [137], the ACS NSQIP Myocardial Infarction and Cardiac Arrest (MICA) calculator, or the American College of Surgeons NSQIP Surgical Risk Calculator [137–139]. For patients whose risk is estimated to be <1%, further testing is not recommended. Notably, there has been 1 report of a risk-scoring system published for bariatric patients specifically. Gondal et al. [133] identified that age >50 years, preoperative renal insufficiency, hyperlipidemia, and a previous history of myocardial infarction were associated with perioperative myocardial infarction in bariatric patients. It is uncertain yet whether this bariatric-specific scoring system offers any advantage over other general established risk calculators.

Using the RCRI as an example, a hypothetical bariatric patient would receive 1 point for any of these risk factors: a history of heart failure, cerebrovascular disease, type 2 diabetes requiring treatment with insulin, serum creatinine >2.0 mg/dL, or ischemic heart disease (defined as a history of myocardial infarction, a positive exercise test, chest pain from myocardial ischemia, the use of nitrate therapy, or an electrocardiogram with pathological Q waves). Note that prior coronary revascularization procedures are not given a risk point unless one of the other criteria for ischemic heart disease is present [136].

If any one of these RCRI risk factors is present, functional capacity should be assessed. Because physician assessment of functional capacity can be subjective, use of an objective survey, such as the Duke Activity Status Index (DASI), is encouraged [140]. The DASI is simple to administer and score. Patients with predicted >4 metabolic equivalents can proceed to surgery; otherwise, patients should undergo pharmacologic stress testing. If stress testing shows no inducible ischemia, patients may proceed to surgery. Otherwise, referral to a cardiologist and consideration of coronary revascularization, with delay of bariatric surgery, is indicated [136]. When this algorithm is used, the vast majority of bariatric patients may safely proceed to surgery with just a preoperative electrocardiogram and DASI survey documenting >4 metabolic equivalents of predicted functional capacity [136,140].

A preoperative resting electrocardiogram might be helpful for other reasons, such as serving as a baseline for comparison in the event of postoperative changes, especially in older patients. A standard age or risk factor cutoff to serve as a basis for obtaining a preoperative electrocardiogram has not been defined. The optimal time interval between surgery

and the last electrocardiogram is also unknown, with consensus suggesting that an interval of 1–3 months is adequate for stable patients [136]. Routine resting echocardiography is not recommended except to evaluate dyspnea of unknown origin, or in patients with worsening heart failure.

Other indications for cardiology referral. Referral to a cardiologist should also be considered for patients with recent myocardial infarction, unstable angina, decompensated heart failure, high-grade arrhythmias, or hemodynamically significant valvular heart disease (aortic stenosis in particular) because they are at high risk for adverse cardiac events [141]. These patients will undergo specialized evaluation; supplemental preoperative testing would then be considered by the cardiologist. Medications, including β -blockers, will be reviewed and optimized. While initiating β -blockers in patients at elevated risk as a perioperative cardiac risk reducing strategy may be reasonable, it is not advisable to start β -blockers on the day of surgery without allowing some time for tolerability and safety to be established before surgery; β -blockers should be continued in patients who have been using them chronically [136].

Recommendations for preoperative cardiac screening

- Bariatric patients should undergo cardiac risk assessment with a validated risk calculator, such as the Revised Cardiac Risk Index, and assessment of functional capacity. Based upon the results, patients should be referred to a cardiologist or primary care provider for additional testing when appropriate.
- Referral to a cardiologist should also be considered for patients with recent myocardial infarction, unstable angina, decompensated heart failure, high-grade arrhythmias, or hemodynamically significant valvular heart disease.
- Because of its significant cardiovascular benefits and very low risk profile, bariatric surgery should be considered even in patients with significant cardiac disease and/or risk.

Physical prehabilitation

The stress of major abdominal surgery can elicit negative physiologic and psychologic effects, and can lead to a decreased postoperative functional capacity [142]. A 20%–40% reduction of functional capacity has been reported in the postsurgical period, even in the absence of complications [143]. A lower preoperative functional status has been associated with both increased morbidity and

mortality and a prolonged postoperative recovery [143,144]. In addition, increased age and poor fitness have been associated with increased critical care requirements, increased readmission rates, and higher costs [142,143,145].

Optimizing a patient's preoperative functional capacity in order to improve postoperative outcomes is known as prehabilitation. Although preoperative pulmonary and exercise interventions have been the major elements evaluated in the literature, current protocols favor a multimodal approach, including nutrition, over exercise alone [146–148]. Prehabilitation typically ranges from 4–12 weeks and is commonly implemented as a component of ERAS protocols. Programs can be supervised by physicians, dietitians, and/or physiotherapists. Materials for patients can include incentive spirometers, pedometers, DVDs, brochures, or daily smartphone messages [149]. In general, prehabilitation before cardiac or abdominal surgery results in lower complication rates and a shorter length of stay [150–153]. However, most studies describe interventions in colorectal, orthopedic, and cardiothoracic patients; reports for bariatric patients are sparse [154].

Exercise programs

Exercise programs should be personalized to the starting functional capacity of the individual and include strengthening exercises or aerobic exercises such as walking, cycling, running, or swimming. There is an inverse relationship between cardiopulmonary fitness and complication rate after bariatric surgery [155]. Aerobic exercise before surgery can improve lung capacity and cardiopulmonary reserve, which translates into improved physiologic reserve during surgery and improved response to stressors [149]. A randomized controlled trial evaluating a personalized exercise program designed and monitored by a physiotherapist before major abdominal surgery showed that enhanced aerobic capacity reduced surgical complications by 50% (RR 0.5; 95% CI: .3–.8; $P = .001$) [156]. Heger et al. [157] performed a metaanalysis of the effect of exercise training prehabilitation on postoperative outcomes after major abdominal surgery. There was a 63% reduction in pulmonary complications (OR .37; .20–.67; $P = .001$) and 48% decreased overall morbidity (OR .52; .30–.88; $P = .01$) in the prehabilitation group compared with standard care. The variability of the interventions was high, and the reporting quality of some of the trials was low.

Pulmonary interventions

Preoperative interventions aimed at reducing postoperative pulmonary complications include inspiratory muscle training and regular use of positive airway pressure therapy for patients diagnosed with obstructive sleep apnea [158,159]. Preoperative inspiratory muscle training, including incentive spirometer and coughing exercises, was associated with a reduction in postoperative atelectasis,

pneumonia, and hospital length of stay in patients undergoing cardiac, thoracic, and abdominal surgery [150,151]. Valkenet et al. [152] found in patients undergoing coronary artery bypass graft surgery that the use of inspiratory muscle training 2–4 weeks preoperatively (incentive spirometry, deep breathing maneuvers, coughing, and early mobilization) significantly increased patient maximum inspiratory pressure and significantly decreased the incidence of pneumonia from 16% to 7%, and average hospitalization from 10 to 8 days [152].

Currently, there are no reports describing prehabilitation programs for bariatric surgery patients specifically.

Recommendations for preoperative exercise and pulmonary training

- Based on studies of patients who underwent major abdominal surgery, prehabilitation with physical exercise and pulmonary interventions may reduce overall complications, pneumonia risk, and hospital length-of-stay. It is unknown whether these benefits apply to patients undergoing laparoscopic bariatric surgery.

Preoperative assessment of obstructive sleep apnea

Prevalence of obstructive sleep apnea

The prevalence of obstructive sleep apnea (OSA) in patients with obesity ranged from 35%–94% across 14 prospective studies using sleep evaluations for diagnosis; 11 of the 14 studies reported prevalence rates >60% [160]. In patients seeking bariatric surgery, the prevalence of OSA may be higher [161]. The risk for OSA increases with male gender, advancing age, and higher BMI [162–164]. Laboratory-based polysomnography is the gold standard for diagnosis. Outpatient polygraphy with home use monitors is also used, but it underreports mild disease [165,166]. OSA is classified according to apnea-hypopnea index: it can be mild (5–15 events/hr), moderate (15–30 events/hr), or severe (>30 events/hr) [167].

Impact of OSA on surgical outcomes

A number of studies have identified OSA as an independent risk factor for adverse events after surgery [168–172]. Memtsoudis et al. [171] analyzed 3,441,262 general surgical procedures listed in the National Inpatient Sample and found that OSA was associated with a 37% increased odds of aspiration pneumonia and almost twice the odds of reintubation. Kaw et al. [170] studied 471 patients who underwent polysomnography before noncardiac surgery and showed that OSA conferred an 8-fold risk of postoperative

hypoxemia, 7-fold risk of overall complications, 4-fold risk of intensive-care transfer, and longer hospitalization. Two meta-analyses and a recent systematic review of 63 publications reviewing 413,576 patients with OSA and 8,557,044 control (non-OSA) patients, confirmed a higher incidence of postoperative oxygen desaturations, cardiac events, and respiratory failure in the presence of OSA [165,173–175].

Preoperative screening for obstructive sleep apnea prior to bariatric surgery

Routine screening for OSA before bariatric surgery has been controversial. Some have questioned the practice because most bariatric candidates will screen positive [162], referral for polysomnography can be time-consuming and costly [176], the data showing effectiveness of continuous positive airway pressure (CPAP) on mitigating respiratory complications in this population are limited and conflicting [170,173,177–182], and bariatric surgery itself induces dramatic improvement in OSA over the long-term [183,184].

An expert panel convened in March 2016 and produced a consensus-based guideline on the perioperative management of OSA in bariatric surgery [160]. The panel recommended screening all patients for OSA before bariatric surgery. Use of the STOP-BANG score, or alternatively, the Berlin Questionnaire, was recommended as a screening tool to identify patients at high risk of OSA. The Epworth Sleepiness Scale was not recommended as a screening tool for OSA, as it had poor correlation to OSA in the bariatric surgery population [160,185]. Recognizing that access to laboratory-based polysomnography can be limited, the panel widely supported the use of home polygraphy as a substitute and adjunct to screening questionnaires. The panel also recommended consideration of screening PaCO₂ and venous HCO₃ to diagnose obesity hypoventilation syndrome in patients diagnosed with OSA, since the 2 conditions can co-exist in up to 20% of patients [160].

Should CPAP be instituted prior to bariatric surgery?

In general, CPAP therapy is recommended for patients with moderate or severe OSA (apnea-hypopnea index ≥ 15 events/hr) to improve symptoms, decrease cardiopulmonary risk, and reduce overall mortality [186].

The perioperative use of CPAP has been linked to reduced pulmonary complications after bariatric surgery in some studies [172,187]. Kong et al. [172] retrospectively reviewed 352 patients who all had OSA confirmed with polysomnography before bariatric surgery. Patients who did not receive CPAP developed more pulmonary complications than those with CPAP, suggesting that CPAP was beneficial. This study, however, has, by design, limited generalizability. Meurgey et al. [187] studied 410 patients screened with STOP-BANG and fitted for CPAP, if indicated, before bariatric surgery. Bariatric patients who were screened preoperatively for OSA and treated according to guidelines had the same low risk of respiratory complications as those without

OSA, indicating that CPAP may have mitigated the risk of respiratory complications [187]. These studies attribute benefit to perioperative CPAP use in bariatric patients.

Others have challenged whether it is necessary to start CPAP before bariatric surgery. O'Reilly et al. [188] studied 510 patients who underwent bariatric surgery and found OSA was not associated with increased post-operative complications. Development of postoperative pulmonary or cardiac complications did not differ significantly between screened and unscreened patients [188]. De Raaf et al. [189] reviewed 13 studies that reported OSA in 37% of 98,935 bariatric patients, finding there was no clear association with OSA and intensive-care admission rates, death, or length of stay, possibly because of already optimized conditions and CPAP use in the evaluated cohorts. These studies, along with others, question the impact of OSA on perioperative outcomes after bariatric surgery [170,173,177–182].

The expert panel recognized that the quality of evidence supporting the use of CPAP to mitigate respiratory complications after bariatric surgery was weak [160]. Nevertheless, after looking at all available data, the panel recommended CPAP for all patients with moderate or severe OSA [160]. For patients diagnosed with moderate or severe OSA and then fitted for CPAP prior to bariatric surgery, acclimatization for a few weeks is recommended, and patients are encouraged to bring their own machine and mask to the hospital; choice of nasal versus full-face masks should be based on patient comfort and effectiveness [160].

The perioperative, in-hospital, and after-discharge management of patients with OSA is equally important to patient outcomes and is beyond the scope of this position statement.

Recommendations for preoperative optimization of obstructive sleep apnea (OSA)

- Bariatric programs should encourage screening for OSA in patients with obesity. Validated screening tools like the STOP-BANG questionnaire or the Berlin Questionnaire can be used for this purpose.
- Patients screened to be at high-risk for OSA can be diagnosed with polysomnography or home respiratory polygraphy, which are both helpful in confirming clinically significant moderate or severe OSA.
- In patients diagnosed with severe OSA and for whom there is concern for obesity-hypoventilation syndrome, consider referral to pulmonologist. Patients with moderate or severe OSA benefit from CPAP in general, and may benefit from CPAP perioperatively, as available or needed, along with careful postoperative monitoring to decrease perioperative pulmonary complications. In patients who cannot tolerate CPAP and have positional OSA, positional therapy is helpful.

Psychosocial optimization

A preoperative psychosocial assessment, conducted by a qualified behavioral health clinician with relevant specialized knowledge, is recommended by professional societies and is required by many third-party payors [2,62]. While these evaluations may identify clear contraindications for surgery, the psychosocial evaluation is best conceptualized as a way to identify strengths and vulnerabilities and develop recommendations to enhance surgical outcome [2,62,190–192]. Because long-term outcome is substantially influenced by patient behaviors, it follows that preoperative psychosocial optimization is important for all patients, not solely those with a history of psychopathology [193,194]. Optimization should include evaluation of psychosocial functioning, substance use, and maladaptive eating patterns [62].

Psychosocial functioning

People with obesity, and to a greater extent, people seeking bariatric surgery, have an increased prevalence of mental health impairment [195,196]. Such impairment can pose challenges for adjustment and adherence after surgery. Although preoperative psychopathology has not consistently been shown to predict weight loss outcome after bariatric surgery, in part because patients with severe, uncontrolled psychopathology are typically not included in the studied surgical cohorts [192,196–199], it is clear that postoperative psychopathology is a robust predictor of poor weight loss outcomes [193,195,200,201].

Weight loss is not the only important outcome; preoperative psychopathology is associated with longer hospital stays, increased complications, and increased readmission rates [202–205]. Additionally, preoperative psychiatric symptoms, cognitive factors, attention deficit/hyperactivity disorder, poor health literacy and numeracy, and general cognitive deficits are also associated with worse recall of, and adherence to, the postoperative dietary regimen and attendance at follow-up visits [206–210].

After surgery, there is a documented risk of severe, and potentially life-threatening postoperative psychopathology. Prevalence of suicidality and self-harm are significantly elevated among individuals who have undergone bariatric surgery [211–214]. Given the serious nature of these complications, optimization of any existing psychiatric symptoms is vital [213,214].

It is important to note that the mere presence or absence of a particular psychiatric condition has less relevance to postoperative outcomes than the patient's current general psychosocial functioning, the severity of any psychiatric symptoms, and whether symptoms are being well-managed. Several studies have demonstrated that patients with psychiatric vulnerabilities identified at the psychosocial evaluation (including severe conditions such as bipolar

or psychotic disorders), whose symptoms were optimized before surgery, were able to attain favorable postsurgical weight loss and psychosocial outcomes [196,198,199,215–218]. These studies suggest that preoperative psychosocial optimization is both feasible and effective [219].

For patients with pre-existing psychosocial issues, it is important to ensure that symptoms are being adequately managed and that a behavioral health provider is involved to monitor and support the patient after surgery. Input should be sought from current and recent outside behavioral health providers regarding the patient's functioning, adherence, and any concerns that the provider may have about the patient undergoing surgery. Patients treated with psychotropic medications and their prescribing providers should be educated about the possible need for medication adjustments due to changes in absorption after bariatric surgery [196,198,220]. Patients should also be educated about the risk of continued/recurrent psychosocial symptoms after surgery and an action plan created should adverse psychosocial reactions arise.

Bariatric surgery leads to major changes in interpersonal interactions and relationships, day-to-day functioning, body image, and other psychosocial domains [201,221,222]. In addition, bariatric surgery requires behavioral changes that must be maintained for long-term success [201,222]. Adjustment to these changes can be challenging for any patient, not just those with a pre-existing history of mental health issues. Various general psychosocial factors beyond formal psychiatric symptoms, such as impulsivity or conscientiousness, emotion regulation and coping skills, health literacy, and social support are increasingly being found to be associated with bariatric surgical outcomes and thus represent important domains for preparation and support [206,223–231].

Substance use

The preoperative psychosocial assessment should include a review of current and past substance use [2,62,232–235]. A history of a long-resolved substance use disorder has not been found to predict worse surgical outcomes and is therefore not considered a contraindication for surgery [234,236]. However, current substance use disorders are a contraindication for bariatric surgery [62,234], due to concerns including perioperative safety risks and the potential impact on diet adherence, weight loss, and general health [233,237,238].

Patients with high-risk patterns of substance use may be referred for addiction services [232,234]. While research has not clearly demonstrated that bariatric surgery poses a risk for relapse in patients with previously remitted substance abuse [239], the length of abstinence needed to minimize the risk of relapse after bariatric surgery has not been determined [240]. The need for thoughtful pain management planning extends to all patients, but particular care should be taken for patients with a history of opioid use

disorder to minimize the risk of perioperative opioid use triggering a relapse [241].

De novo substance abuse after bariatric surgery can be a serious complication [242]. Several studies have documented new-onset alcohol use disorders among patients who have undergone gastric bypass and sleeve gastrectomy [233,239,243,244], and others have found increased risk of other drug use disorders and “addictive” behaviors (such as excessive spending, gambling, or sexual behaviors) [245]. Risk factors for postoperative substance abuse include male sex, smoking, younger age, any/regular alcohol use, low levels of social support, low income, treatment with antidepressant medications, depression or bipolar disorder, a history of psychiatric hospitalization, and a family history of substance use disorder [232,233,238,244,246–248]. Patients with such risk factors should be identified before surgery to ensure they receive appropriate education, monitoring and support before and after surgery. Additionally, all patients should be educated about changes in the pharmacodynamics of alcohol after gastric bypass and sleeve gastrectomy, as well as the risks for substance abuse disorder, behavioral addictions, illicit drug use, and chronic opioid medication use [232,234,237,238,240,241,249–252].

Maladaptive eating patterns

The preoperative psychosocial evaluation should also include a review of current and past eating disorder symptoms [62]. Binge eating disorder, defined as eating unusually large amounts of food in a short period of time while experiencing a loss of control over eating, along with other associated symptoms, is the most common eating disorder among patients seeking bariatric surgery [253,254]. Less is known about the relationship between bariatric surgery and other pathologic eating behaviors, such as grazing, compensatory behaviors (e.g., excessive exercise or self-induced vomiting to lose weight) and emotional eating. Research regarding the relationship between preoperative eating disorders and surgical outcomes has been mixed. Although some studies suggest that preoperative eating disorders predict less weight loss, most studies find no significant association [255,256]. What is clear from the literature is that eating disorders before surgery predict eating disorders after surgery [254,257,258]. This is important because eating disorders after bariatric surgery have robustly been shown to predict poor weight loss and/or weight regain [200,254,257,259–265]. Loss of control eating, emotional eating, grazing, and evening overeating have all been found to be correlated with poor dietary adherence, which in turn has been found to impair weight loss outcomes [266]. Such eating pathology is not limited to those with pre-surgical eating disorders; emergence of de novo loss of control eating, binge eating disorder, and grazing is not uncommon after bariatric surgery. Finally, disordered eating

after bariatric surgery is associated with increased psychological distress and worse quality of life [257,259,262,265,267].

Although eating disorders are generally not considered absolute contraindications for bariatric surgery, patients and providers should be aware that eating disorder symptoms can manifest after surgery and compromise weight loss, mental health, and quality of life. Preoperative optimization involves ongoing assessment, monitoring, education, and, in some cases, intervention to help patients problem-solve how to overcome barriers that are likely to persist after surgery. Interventions include cognitive-behavioral group therapy, which has been shown to improve disordered eating, psychological distress, self-esteem, and weight before surgery [268–270]. Cognitive-behavioral therapy may also improve medium-term postoperative weight loss, even when delivered in as few as 4 sessions [271,272]. In light of research suggesting that patients who are referred to post-surgical eating disorder treatment are more likely to complete treatment than patients referred before surgery, another option is to defer eating disorder treatment until after surgery, as needed [273].

Recommendations for preoperative psychosocial optimization

- Patients seeking bariatric surgery should receive an evaluation that includes assessment of psychosocial functioning, substance use, and maladaptive eating patterns.
- For patients with psychopathology, ensure symptoms are being adequately managed and treated.
- Patients with current high-risk patterns of substance use should be considered for referral to specialist or other addiction services.
- For patients with eating disorders, consider referral for behavioral treatment such as cognitive behavioral therapy.
- Patients should be educated about substance use disorders and maladaptive eating patterns that can occur after bariatric surgery.

Disclosures

The authors have no commercial associations that might be a conflict of interest in relation to this article.

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