

White Paper AGA: POWER — Practice Guide on Obesity and Weight Management, Education and Resources

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The epidemic of obesity continues at alarming rates, with a high burden to our economy and society. The American Gastroenterological Association understands the importance of embracing obesity as a chronic, relapsing disease and supports a multidisciplinary approach to the management of obesity. Because gastrointestinal disorders resulting from obesity are more frequent and often present sooner than type 2 diabetes mellitus and cardiovascular disease, gastroenterologists have an opportunity to address obesity and provide an effective therapy early. Patients who are overweight or obese already fill gastroenterology clinics with gastroesophageal reflux disease and its associated risks of Barrett's esophagus and esophageal cancer, gallstone disease, nonalcoholic fatty liver disease/nonalcoholic steatohepatitis, and colon cancer. Obesity is a major modifiable cause of diseases of the digestive tract that frequently goes unaddressed. As internists, specialists in digestive disorders, and endoscopists, gastroenterologists are in a unique position to play an important role in the multidisciplinary treatment of obesity. This American Gastroenterological Association paper was developed with content contribution from Society of American Gastrointestinal and Endoscopic Surgeons, The Obesity Society, Academy of Nutrition and Dietetics, and North American Society for Pediatric Gastroenterology, Hepatology and Nutrition, endorsed with input by American Society for Gastrointestinal Endoscopy, American Society for Metabolic and Bariatric Surgery, American Association for the Study of Liver Diseases, and Obesity Medicine Association, and describes POWER: Practice Guide on Obesity and Weight Management, Education and Resources. Its objective is to provide

physicians with a comprehensive, multidisciplinary process to guide and personalize innovative obesity care for safe and effective weight management.

Keywords: ■■■.

The POWER model presents a continuum of care that is based on 4 phases: (1) assessment, (2) intensive weight loss intervention, (3) weight stabilization and re-intensification when needed, and (4) prevention of weight regain. Although lifestyle changes including reduced calorie diet and physical activity are the cornerstones of treatment, new medications, bariatric endoscopy, and surgery are important tools to help patients with obesity achieve realistic goals.

Management Summary

1. Nutrition: reduce dietary intake below that required for energy balance by consuming 1200–1500 calories per day for women and 1500–1800 calories per day for men.
2. Physical Activity: reach the goal of 10,000 steps or more per day.
3. Exercise: reach the goal of 150 minutes or more of cardiovascular exercise/week.
4. Limit consumption of liquid calories (ie, sodas, juices, alcohol, etc).

Abbreviations used in this paper: AGA, American Gastroenterological Association; BMI, body mass index; CI, confidence interval; CVD, cardiovascular disease; ER, extended release; FDA, Food and Drug Administration; GERD, gastroesophageal reflux disease; GLP-1, glucagon-like peptide 1; 5-HT, 5-hydroxytryptamine; NAFLD, nonalcoholic fatty liver disease; NASH, nonalcoholic steatohepatitis; NASPGHAN, North American Society for Pediatric Gastroenterology, Hepatology and Nutrition; POMC, pro-opiomelanocortin; SAGES, Society of American

Gastrointestinal and Endoscopic Surgeons; SR, sustained release; T2DM, type 2 diabetes mellitus; TORe, transoral outlet reduction; TOS, The Obesity Society; TBWL, total body weight loss.

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- Utilize a tool to support and adhere to the low calorie food intake.

POWER: Practice Guide on Obesity and Weight Management, Education and Resources

Objective:

To create a comprehensive, multidisciplinary process to guide personalized, innovative obesity care for safe and effective weight management.

Methods:

Experts in each field of obesity developed this practice guide that is based, in its majority, in societal guidelines.

Why Treat Obesity in Gastroenterology Clinics?

The epidemic of obesity continues at alarming rates, with a high burden to our health, economy, and society. The American Gastroenterological Association (AGA) understands the importance of embracing obesity as a chronic disease and supports a multidisciplinary approach to the management of obesity. Because gastrointestinal disorders resulting from obesity are more frequent and often present sooner than type 2 diabetes mellitus (T2DM) and cardiovascular disease (CVD), gastroenterologists have an opportunity to address obesity and provide effective therapy. People who are overweight and obese are overrepresented in gastroenterology clinics, because they present with nonalcoholic fatty liver disease (NAFLD) and nonalcoholic steatohepatitis (NASH), gastroesophageal reflux disease (GERD), and other diseases associated with increased risk related to obesity, such as Barrett's esophagus and esophageal cancer, gallstone disease, and colon cancer. Obesity is a major modifiable cause of diseases of the digestive tract that routinely goes unaddressed. The gastroenterologist is in a unique position to play an important role in the multidisciplinary treatment of obesity. We are internists, specialists in digestive disorders, and endoscopists. Hence, in this paper, the AGA partnered with Society of American Gastrointestinal and Endoscopic Surgery (SAGES), The Obesity Society (TOS), Academy of Nutrition and Dietetics, and the North American Society for Pediatric Gastroenterology, Hepatology and Nutrition (NASPGHAN) to develop "POWER: Practice Guide on Obesity and Weight Management, Education and Resources," with the mission of providing physicians a comprehensive, multidisciplinary process to guide innovative obesity care for safe and effective weight management. Further input and official

endorsement of POWER were provided by the American Society for Metabolic and Bariatric Surgery, the Obesity, Metabolism and Nutrition section of the American Gastroenterological Association Institute Council, the American Society for Gastrointestinal Endoscopy and its Association for Bariatric Endoscopy, the American Association for the Study of Liver Diseases, and Obesity Medicine Association.

Obesity is a chronic, relapsing, multifactorial disease defined as abnormal or excessive adipose tissue accumulation that may impair health and increase disease risks significantly.¹ Multiple pathogenic adipocyte and/or adipose tissue endocrine and immune dysfunctions contribute to metabolic disease (adiposopathy or "sick fat" disease). Separate but overlapping physical forces from excessive body fat cause damage to other body tissues (fat mass disease), including adverse metabolic, biomechanical, and psychosocial health consequences.² The excess of adipose tissue is the outcome of a multifactorial etiopathogenesis: genetics, biological, microbial, and environmental factors. These factors promote a positive energy balance mainly driven by an increase in food intake and a decrease in energy expenditure.^{3,4}

Normal weight, overweight, and obesity can be measured by body mass index (BMI). BMI is calculated by weight (kg) divided by the square of the height (m²). The BMI for a normal-weight adult ranges from 18.5 to 24.9 kg/m², overweight is from 25 to 29.9 kg/m², and obese is 30 kg/m² or above. Obesity is considered severe when BMI is higher than 40 kg/m².⁵ In children, obesity is measured as BMI higher than the 95th percentile related to age and sex.^{6,7}

Obesity can also be assessed by waist circumference, with abdominal obesity defined as >102 cm (40 inches) or waist-to-hip ratios >0.9 in men and 88 cm (35 inches) or waist-to-hip ratios >0.85 in women. Elevated BMI and waist circumference are associated with increased health risks and obesity-related comorbidities.⁵

Obesity has reached epidemic proportions in developed countries, and its prevalence is increasing in developing countries.⁷ In the United States, the prevalence of overweight adults is 69% and adults with obesity is 36.5%.^{8,9} In children and adolescents, obesity prevalence has increased to 16.9%.⁸ The World Health Organization indicated that globally in 2005 there were approximately 2 billion overweight adults and 500 million of those with obesity.¹⁰ This alarming obesity epidemic poses a heavy burden to the U.S. economy, costing more than \$150 billion every year or 10% of the total health budget (Centers for Disease Control and Prevention, 2012).

Health Consequences of Obesity

In the United States, obesity is linked to the top 10 causes of death and associated comorbidities before death.¹¹ Mortality risk increases as BMI increases.¹² Obesity is related to numerous pathologic conditions,

including CVD,¹³ T2DM,¹⁴ sleep apnea,^{15–18} cancer,¹⁹ reproductive disorders,²⁰ endocrine disorders,²¹ psychological disorders,^{22–25} bone, joint, and connective tissue disorders,^{26,27} and gastrointestinal disorders.²⁸

Appendix 1 summarizes the quantified risks of gastrointestinal disorders in obesity.²⁸ The increased prevalence of gastrointestinal morbidity in the general population may be related to the increased prevalence of obesity in Western countries. Thus, it is important to recognize the role of higher BMI and, particularly, increased abdominal adiposity in the development of gastrointestinal morbidity. Furthermore, higher BMI is associated with poorer response to treatment, and conversely, many gastrointestinal diseases improve with weight loss alone, eg, NAFLD and GERD.

Obesity Management: POWER Program Guide

Multidisciplinary Team

Treating obesity is best accomplished when physicians partner with other professionals with specific expertise in the nutritional, behavioral, and physical activity aspects of treatment. This partnership is referred to as a multidisciplinary team, and as with oncology or other chronic disease care teams, the program works best when there is regular, scheduled communication between members of the team. An ideal comprehensive team may include a physician with training in obesity medicine or gastroenterologist with expertise in nutrition, bariatric surgeons, endoscopists, a physician assistant, nurse practitioner or nurse, a registered dietitian nutritionist, a psychiatric social worker, psychiatrist or psychologist, and medical assistants. The composition of the team and roles that different team professionals fulfill can vary on the basis of the expertise and resources available in each clinical setting. The gastroenterologist can lead the multidisciplinary team and use the tools available or become part of a team and provide endoscopic support for bariatric endoscopy devices and manage complications of bariatric surgery.

Goals and Patient Outcome for Treatment of Obesity

Obesity, a chronic, relapsing, multifactorial disease, needs a care model that is based on a continuum of 4 phases: (1) assessment, (2) intensive weight loss intervention, (3) weight stabilization, and re-intensification when needed, and (4) prevention of weight regain (Figure 1). Each phase should be addressed separately with the best evidence available with realistic goals and proceed through the phases as goals are met.

Obesity prevention is as important as obesity treatment. When setting weight loss goals, it is important to educate the patient that the objectives should be driven by the medical

consequences associated with obesity, along with the individual's personal motivation to make healthy changes.

The facility. Because patients' willingness to participate in obesity treatment may be impacted by perceived prejudice or disapproval, the care of patients with obesity requires appropriate office equipment and supplies to ensure patient comfort. The office should be equipped with oversized chairs, appropriately sized gowns, oversized blood pressure cuffs, long tape measures for measuring waist circumference, and weighing scales that can accommodate patients weighing up to at least 500 pounds. An office with larger doorways to accommodate extra wide wheelchairs and motorized scooters is also beneficial. A facility that can accommodate a team of clinicians is ideal; however, referrals to other sites can also be a successful model. A successful existing model for ensuring structural standards for the obese patient is the Metabolic and Bariatric Surgery Accreditation and Quality Improvement Program.²⁹

Assessment of readiness. It is important to assess patient readiness to embark on a weight loss program before initiating a treatment plan, because some patients are not motivated to make the necessary changes to lose weight or are not even ready to discuss their weight. The modified 5 A's (Ask, Advise, Assess, Assist, and Arrange), which were developed for smoking cessation, also serve as an effective tool for obesity counseling.³⁰ It has been demonstrated that simply giving patients advice to change is often unrewarding and ineffective; motivational interviewing is a useful technique to communicate with patients about weight management.³¹

The 2013 American Heart Association/American College of Cardiology/TOS Guidelines for the Management of Overweight and Obesity in Adults recommends that the clinician, together with the patient, assess whether the patient is prepared and ready to undertake the measures necessary to succeed at weight loss before beginning comprehensive counseling efforts.⁵ Motivational interviewing by using Open-ended Questions, Affirmation, Reflections, and Summaries (OARS) is another useful tool.^{32,33} If the patient is not prepared to undertake these changes, attempts to counsel the patient on how to make lifestyle changes are likely to be ineffective and potentially counterproductive.⁵

Broaching the need for treatment. Clinical encounters for obesity-related comorbidities in gastroenterology practice include NAFLD, reflux esophagitis, gallbladder disease, pancreatitis, and colon cancer. Visits for these conditions are opportunities to address weight management. The 2013 American Heart Association/American College of Cardiology/TOS Obesity Guidelines recommend that patients with overweight or obesity and cardiovascular risk factors (hypertension, hyperlipidemia, and hyperglycemia) be counseled that lifestyle changes that produce even modest, sustained weight loss of 3%–5% produce clinically meaningful health benefits, and that greater weight loss produces greater benefits.⁵ Patients should be informed that this amount of weight loss is likely to result

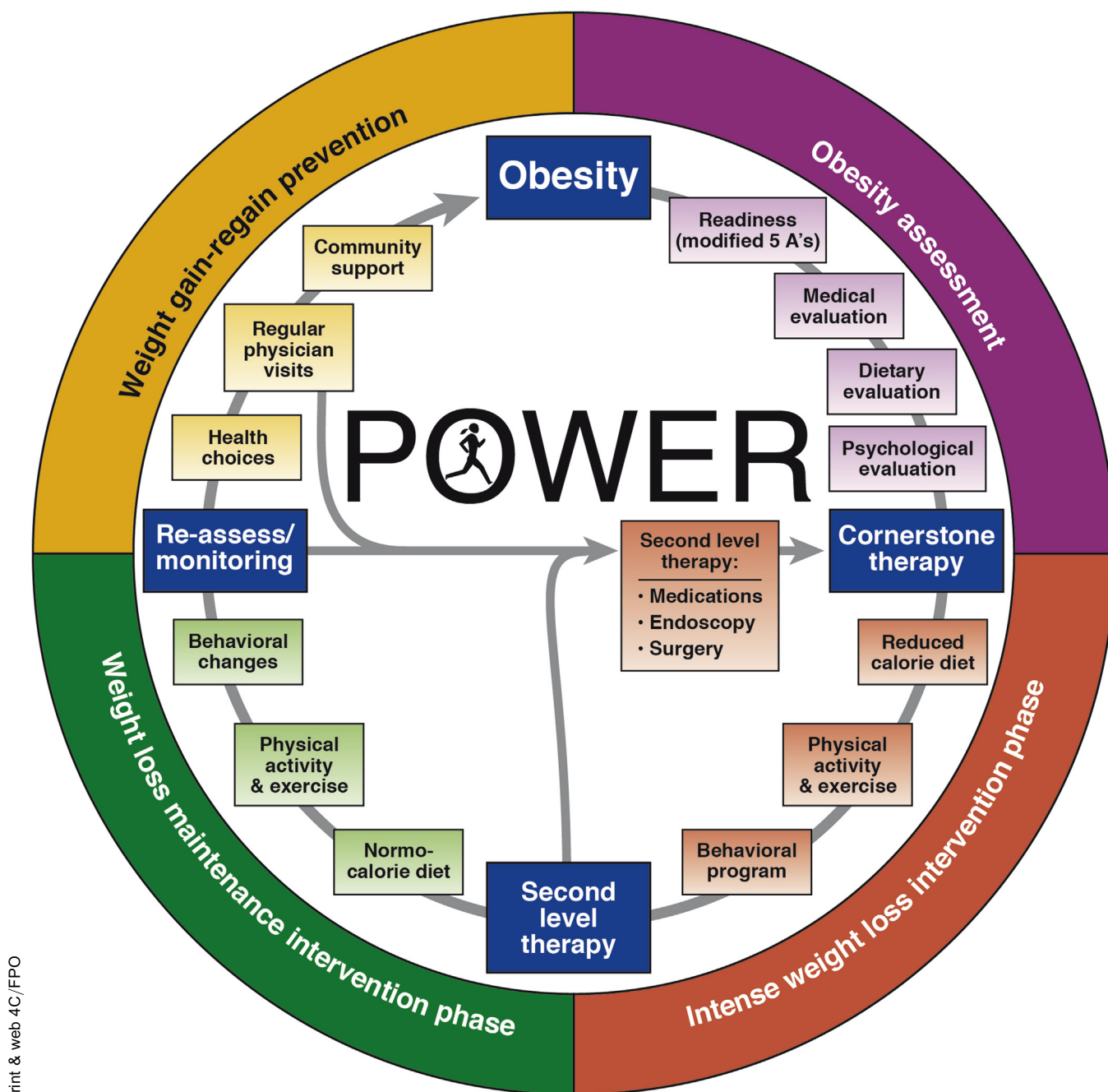


Figure 1. POWER: Practice Guide on Obesity and Weight Management, Education and Resources.

in clinically meaningful reductions in triglycerides, blood glucose, and hemoglobin A1c and the risk of developing T2DM. Gastrointestinal disorders, including NAFLD³⁴ and GERD,³⁵ have also been shown to improve with weight loss. Importantly, addressing obesity decreases the risk of multiple types of cancer. Identifying patient's personal concerns can help identify areas that will foster motivation and inspiration and represent an important strategy.

Medical Evaluation

The medical evaluation of a patient with obesity should include an assessment for underlying etiologies, a

screen for causes of secondary weight gain, and identification of obesity-related comorbidities. [Table 1](#) illustrates the steps a clinician should take in a clinical encounter. Patients should be asked about contributing factors, including family history, sleep disorders, and medications associated with weight gain ([Appendix 2](#)). If history and/or physical examination raise suspicion for identifiable causes of obesity ([Table 2](#)), patients should undergo appropriate screening, eg, for cardiac disease or obstructive sleep apnea.

The 2013 Obesity Guidelines provide an algorithm for approaching patients with overweight and obesity ([Appendix 3](#)).⁵ When eliciting a medical history,

Table 1. Steps a Clinician Should Take in a Clinical Encounter With a Patient With Overweight or Obesity

- Annual and symptom-based screening for chronic conditions associated with obesity
- Timely adherence to national cancer screening guidelines (patients with obesity are at increased risk for many malignancies)¹⁰¹
- Identification of contributing factors including genetics, disordered eating, sleep disorders, family history, and environmental/socio-economic causes
- Identification of and appropriate screening for secondary causes of obesity (Table 2) if history and/or physical exam is suggestive
- Identify important comorbidities of obesity and metabolic syndrome: cardiac, T2DM, hyperlipidemia, hypertension, NAFLD/NASH
- Identification of medications that contribute to weight gain (Table 4); prescription of medications that are weight-neutral or promote weight loss when possible
- Adherence to the AHA/ACC/TOS Guideline for the Management of Overweight and Obesity in Adults, which was updated in 2013 and includes recommendations for assessment and treatment with diet, exercise, and bariatric surgery⁵
- Adherence to the Endocrine Society Clinical Practice Guideline for Pharmacological Management of Obesity if pharmacotherapy is indicated
- Formulation of a treatment plan that is based on diet, exercise, and behavioral modifications on the basis of multidisciplinary team evaluation and recommendations

NOTE. Adapted from Apovian CM, Aronne LJ, Bessesen DH, et al.⁴⁴

providers should make sure to ask about prior weight loss attempts, history of weight gain and loss, dietary habits, physical activity and limitations, family history of obesity and comorbidities, and medications that could affect weight (Appendix 2).

Table 2. Selected Causes of Obesity

Primary causes	Secondary causes
<ul style="list-style-type: none"> • Monogenic disorders <ul style="list-style-type: none"> ◦ Leptin deficiency ◦ Melanocortin-4 receptor mutation ◦ POMC deficiency • Syndromes <ul style="list-style-type: none"> ◦ Alström ◦ Bardet-Biedl ◦ Cohen ◦ Froehlich ◦ Prader-Willi 	<ul style="list-style-type: none"> • Drug-induced <ul style="list-style-type: none"> ◦ Anticonvulsants ◦ Antidepressants (eg, tricyclic antidepressants) ◦ Antidiabetics (eg, sulfonylureas, glitazones) ◦ Antihypertensives (eg, beta blockers) ◦ Antipsychotics ◦ Glucocorticoids ◦ Oral contraceptives • Endocrine <ul style="list-style-type: none"> ◦ Cushing syndrome ◦ Growth hormone deficiency ◦ Hypothyroidism ◦ Pseudohypoparathyroidism • Neurologic <ul style="list-style-type: none"> ◦ Brain injury ◦ Brain tumor ◦ Cranial irradiation ◦ Hypothalamic obesity • Psychological <ul style="list-style-type: none"> ◦ Depression ◦ Eating disorders

NOTE. Adapted from Apovian CM, Aronne LJ, Bessesen DH, et al.⁴⁴

Assessment of all patients should include evaluation of BMI, waist circumference, and a complete physical examination. Central obesity is an independent risk factor for mortality,³⁶ so it is also important to measure waist circumference or waist-to-hip ratio.³⁷ The physical exam should focus on characterizing obesity and evaluating for causes and associated complications. A routine physical exam should include inspection for acanthosis nigricans (associated with insulin resistance), hirsutism (associated with polycystic ovarian syndrome), large neck circumference (associated with obstructive sleep apnea), and thin, atrophic skin (associated with Cushing's disease).

Basic laboratory evaluation should include a comprehensive metabolic panel, fasting lipid profile, and thyroid function tests. The U.S. Preventive Services Task Force now recommends screening for abnormal blood glucose as part of cardiovascular risk assessment in adults aged 40–70 years with overweight or obesity.³⁸ Laboratory testing for specific conditions should be done, depending on the findings on history and physical examination.

It is important to screen for symptoms suggestive of CVD and other obesity-related comorbidities. Obstructive sleep apnea and obesity hypoventilation syndrome are common in patients with obesity, particularly severe obesity. The Epworth Sleepiness Scale³⁹ and the STOPBANG questionnaire are useful tools to assess sleep apnea (Appendixes 4 and 5). Screening for common gastrointestinal complications of obesity including NASH, reflux esophagitis, gallbladder disease, and colon cancer should be undertaken if clinically appropriate. Although screening guidelines do not differ on the basis of patient BMI, providers should keep in mind that patients with more severe obesity are at increased risk.

Several prescription medications have been associated with weight gain. Appendix 2 provides a list of medications associated with weight gain, weight neutrality, and weight loss. Medication-induced weight gain is a preventable cause of obesity that can be avoided by choosing alternative treatments that are weight-neutral or promote weight loss. If there are no appropriate alternatives, choose the minimal dose required to produce clinical efficacy to prevent drug-induced weight gain.

Nutrition Evaluation

A nutrition evaluation identifies the patient's relationship with food, food allergies and intolerances, food environment, and nutritional status and can focus on appetite, satiation, and satiety (Academy of Nutrition and Dietetics Weight Management Position Paper that provides an overview of a nutrition assessment: <http://www.eatrightpro.org/resource/practice/position-and-practice-papers/position-papers/weight-management>).

Many obese individuals are in fact malnourished. They often have multiple micronutrient deficiencies because of consumption of foods that are calorically dense but often lacking in sufficient micronutrient content. They may also have insufficient muscle (sarcopenia). Gathering this information will facilitate treatment decisions in a personalized care plan.⁴⁰ Data have shown that patients who regularly record their food intake lose significantly more weight than those who do so inconsistently,⁴¹ so it is important to assess a patient's ability and willingness to keep food logs, ideally reading food labels and using measuring tools to increase the accuracy of the log.

In addition, patients often make better food choices when they cook or plan meals, so it is helpful to discuss a patient's schedule as well as time and resources available to prepare meals; there are also many commercial programs and software (apps) that can assist in food preparation, tracking, and calorie counting.

Physical Activity and Exercise Evaluation

Physical activity and exercise assessment should include an exploration of the patient's usual degree of physical activity, any limiting factors such as joint disease or previous injuries, types of physical activity the patient finds enjoyable and has access to, and a measurement, preferably by an exercise specialist, of the current fitness level. An exercise stress test is not required unless CVD is suspected. It is important to prescribe and have the patient document an approximate number of steps per day and minutes of cardiovascular activity per week.

Psychosocial Evaluation

A patient's psychosocial situation should be assessed, because behavioral modification is a critical component to successful obesity management. Health care providers can obtain a psychological history including eating triggers such as anxiety, depression, or fatigue. A simple screening form is the Weight Efficacy Lifestyle Questionnaire Short-Form (Appendix 6). A higher Weight Efficacy Lifestyle Questionnaire Short-Form total score (>53 points) is associated with higher weight management self-efficacy and motivation to make positive lifestyle changes.⁴² A patient with a lower score should be referred to a health care professional experienced in the area of obesity counseling and behavioral therapy. In addition, body image disturbances and maladaptive eating patterns such as binge eating should be screened for and may require referral to a mental health provider, particularly an eating disorders specialist. Depression is not uncommon in patients with overweight and obesity, and the Patient Health Questionnaire-9 is useful for screening and monitoring the severity of depression (http://www.cqaimh.org/pdf/tool_phq9.pdf).

POWER Program Guide

The cornerstone of obesity management is helping people transition from a pro-obesogenic to a healthy lifestyle. A healthy lifestyle is the key to long-term success and should be based on a normocaloric-eucaloric diet and regular physical activity. The adoption of a healthy lifestyle will support successful weight loss maintenance and prevent weight re-gain. However, it may not facilitate adequate weight loss; thus, the multidisciplinary team should embrace a weight loss program, followed by a weight loss maintenance program.

A weight loss program focuses on a low-caloric diet, while adopting an education and support program for developing behavioral changes. Many tools can be used to support the low-caloric diet to help patients achieve significant sustained weight loss. These tools include structured behavioral programs, specific diets, exercise programs, medications, bariatric endoscopic interventions, and surgery. They can be used alone, sequentially, or in combination to assist in weight loss and weight loss maintenance (Figure 1).

The cornerstones: diet, behavior change, and physical activity. The 2013 Obesity Guidelines suggest that to achieve weight loss, an energy deficit is essential. Reducing dietary energy intake below that required for energy balance can be achieved through a reduction of daily calories to 1200–1500 for women and 1500–1800 for men (kilocalorie levels are usually adjusted for the individual's body weight and physical activity levels) or estimation of individual daily energy requirements and prescription of an energy deficit of 500 kcal/d or 750 kcal/d. Recommendations for young children through adolescence vary to support normal growth and development occurring during these years. The Academy of Nutrition and Dietetics Evidence Analysis Library recommends no fewer than 900 kcal/day for 6- to 12-year-olds who are medically monitored and no fewer than 1200 kcal/day for 13- to 18-year-olds (Academy of Nutrition and Dietetics Weight Management Position Paper that provides an overview of a nutrition assessment: <http://www.eatrightpro.org/resource/practice/position-and-practice-papers/position-papers/weight-management>). Evidence supports greatest long-term success with an individualized, structured meal plan in place. A registered dietitian nutritionist can play an important role in designing the nutrition intervention tailored to address each patient's unique needs and circumstances, taking into consideration factors such as insulin resistance. Any diet program that meets this required energy deficit is appropriate to adopt, and comparative trials have shown no long-term superiority between different macronutrient composition or elimination diets. Furthermore, it is important to adhere to a balanced diet that provides a variety of items from all food groups and limits potentially harmful food ingredients such as added sugars, sodium, and alcohol. In addition, we recommend limiting or avoiding liquid

calories (ie, sodas, juices, alcohol, etc). Finally, the meal plan should be designed in such a way that the individual is likely to follow it.

Along with the prescription for a reduced calorie diet, a comprehensive lifestyle intervention program should prescribe increased aerobic physical activity (such as brisk walking) for ≥ 150 min/week (equal to ≥ 30 min/d most days of the week) and a goal of $>10,000$ steps per day. Higher levels of physical activity, approximately 200–300 min/wk, are recommended to maintain the weight loss or minimize weight regain in the long term (>1 year).⁴³ The diet and physical activity can be in combination with a hospital/university or commercial behavior program; these are comprehensive lifestyle interventions that usually provide structured behavior strategies to facilitate adherence to diet and activity recommendations. These strategies include regular self-monitoring of food intake, body weight, physical activity, and food cravings. These same behaviors are recommended to maintain lost weight, with the addition of frequent (ie, weekly or more frequent) monitoring of body weight.⁵

Successful treatment of obesity requires sufficient time and frequent monitoring to ensure ongoing motivation and accountability. Recommended high-intensity lifestyle interventions include 14 visits during a period of 6 months (weekly for the first month, biweekly for months 2–6) and monthly thereafter for 1 year.⁵ The most effective visit frequency intervals when behavioral treatment is combined with medication or procedures have not been definitively established, but most available evidence suggests that greater frequency is better. The bariatric surgery literature suggests evaluation at a minimum every 3 months during the first year and then every 6 months while weight loss is maintained. Intensification of visits and therapy is warranted for relapse. These visits can be performed in the office or virtually by a health coach.

PRACTICE GUIDE: Registered dietitian nutritionists, psychologists, health coaches, and physical therapists should be identified in the community (Appendix 7) or hired to be part of their team. In addition, commercial programs, online software, or mobile apps can be used to support the “intensive weight loss” phase.

Individualizing Therapy

The current guidelines for weight loss suggest that in addition to the cornerstones of individualized diet and

lifestyle changes, selecting appropriate additional interventions should be based on BMI and comorbidities (Table 3). Physicians should discuss all the appropriate options and their expected weight loss, potential side effects, and figure in the patient’s wishes and goals. Furthermore, physicians should recognize special comorbidities that may favor one intervention over another. Although there are no clear guidelines or society recommendations, certain patient characteristics such as “actionable” gastrointestinal and psychological traits may predict better response to certain treatments.⁴⁰ Thus, it is conceivable that in the future, it may be possible to individualize the best approach for each patient to maximize weight loss and minimize side effects with each intervention.

Intensive Weight Loss Intervention Phase

It has been well-documented that adults with obesity who want to lose weight tend to set unreasonable expectations for the magnitude of weight loss. Although it is not appropriate to set limits on long-term weight loss (as long as the patient does not sink into an undernourished or anorexic state), the best initial weight loss goals are modest ones. This increases the likelihood of success, increases the patient’s confidence, and encourages further efforts to lose weight. It is well-established that weight loss of 5%–10% of initial body weight is sufficient to yield significant health benefits, and a 5% (absolute) weight loss is used by the U.S. Food and Drug Administration (FDA) to assess the efficacy of medications to treat obesity. A practical consideration is that larger amounts of weight loss are progressively more difficult to achieve and maintain. Fortunately, even for individuals with severe obesity, modest weight loss is likely to provide the bulk of the health benefit that would be achieved from complete success in achieving a normal body weight.

Because obesity is a chronic disease that relapses, maintenance and prevention of weight regain after initial successful weight loss (yo-yo effect) are important aspects of ongoing care. Re-establishing goals with the patient whose motivation to lose weight may be declining is essential. Evaluating whether other interventions to assist in weight loss are needed is an important strategy to address both weight regain and plateaus in weight loss. The continuum of care model for

Table 3. Treatment Recommendations for Obesity on the Basis of AHA/ACC/TOS Obesity Guideline¹⁰²

Treatment	BMI category (kg/m^2)				
	25–26.9	27–29.9	30–34.9	35–39.9	>40
Lifestyle: diet, physical activity, behavior therapy	With comorbidities	With comorbidities	+	+	+
Pharmacotherapy		With comorbidities	+	+	+
Endoscopy			+	+	As bridge therapy
Surgery				With comorbidities	+

obesity management, as for other chronic diseases, takes into account the fact that patients are prone to weight gain or regain, regardless of which tool they have used to achieve weight loss.

Weight Stabilization and Intensification Therapy for Relapse Phase

This phase is essential to help patients keep their weight off and prevent weight regain and its associated consequences. Thus, it is important to expose the patient to the attitudes and behaviors that are likely to foster long-term maintenance of weight loss. These may be summarized as setting reasonable goals, reliable support systems within the social environment and the community, keeping records, making it enjoyable, and being flexible. Helping patients lose weight and keep it off requires a comprehensive and sustained effort that involves devising an individualized approach to diet, behavior, and exercise, as described in detail above.

In addition, in the continuum of obesity care, it is essential for both physicians and patients to recognize successes and readdress “failures” as opportunities to learn and adjust behaviors, nutritional support, and physical activities and consider compounding or altering therapies. For example, a patient who is regaining weight after bariatric surgery may be a good candidate for a weight loss medication or for further behavioral intervention, or a patient who is having a poor response to an intragastric balloon may benefit from bariatric surgery or addition of a weight loss medication. Using concomitant strategies can be successful; however, it should be emphasized to the patient that a “tool” or intervention alone will not resolve their obesity. There is no magic pill, procedure, or surgery. On the contrary, using weight loss interventions should be opportunities to encourage the patient about the vital importance of making lifestyle changes for ultimate success.

PRACTICE GUIDE: Incorporate a program that fits your own practice to have continuum interaction with your patients; ideally, the program should be with personal office visits; however, other alternatives such as phone calls, texting, emails, group visits, software-based communication, or apps can be effective as well. Consider working with a health coach or registered nurse to follow up with patients.

Tools to Facilitate Adherence to Reduced Diet

Pharmacotherapy

In addition to diet, exercise, and behavioral modification, pharmacotherapies should be considered as an adjunct to lifestyle changes in patients who have

been unable to lose and maintain weight with diet and exercise alone. They should also be considered in people whose history or clinical circumstances require expedited weight loss. Medication should not be used alone, but in combination with an intensive lifestyle program.

Pharmacotherapy for the treatment of obesity can be considered if a patient has BMI ≥ 30 kg/m² or BMI ≥ 27 kg/m² with weight-related comorbidities such as hypertension, T2DM, dyslipidemia, and obstructive sleep apnea.⁵ Table 4 provides an overview of the medications approved for long-term use including expected outcomes, contraindications, and side effects. Medical therapy should be initiated with dose escalation that is based on efficacy and tolerability to the recommended dose. We suggest assessment of efficacy and safety at least monthly for the first 3 months and then at least every 3 months. We include brief summaries of FDA-approved pharmacotherapy options. Prescribers should refer to each product label for additional detail.

In patients who have CVD, we recommend against prescribing sympathomimetic agents such as phentermine and phentermine/topiramate extended release (ER). Lorcaserin and orlistat are safer alternatives. In patients with T2DM, we suggest antidiabetic agents that promote weight loss such as glucagon-like peptide (GLP-1) analogues that reduce hyperglycemia in addition to the first-line agent for T2DM, metformin.⁴⁴

PRACTICE GUIDE: Medications can improve adherence to a low-calorie diet by mechanisms that include decreasing appetite, increasing satiation, enhancing satiety, and increasing resting energy expenditure. If there is approximate 5% weight loss or less at 12 weeks, discontinue the medication and consider an alternative medication or other treatments. These are summaries of manufacturer product information and should in no way replace guidance found in the package insert and/or updates provided by the manufacturer.

Phentermine (Adipex). Phentermine has been the most commonly prescribed antiobesity medication in the United States since it was approved by the FDA in 1959.⁴⁵ It is approved only for short-term use (3 months); however, many providers prescribe phentermine for longer durations as off-label therapy for continued weight management.

Phentermine is an adrenergic agonist, which promotes weight loss by activating the sympathetic nervous system. Release of norepinephrine causes increased resting energy expenditure and appetite suppression.⁴⁶ The recommended dosage of phentermine is 15–37.5 mg orally once daily, but dosage should be individualized to achieve adequate response with the lowest effective dose. For some patients, a quarter tablet (9.375 mg) or a half tablet (18.75 mg) may be adequate. A split dose of a half tablet 2 times daily is also an option.

Table 4. Overview of FDA-approved Anti-obesity Medications^a

	Phentermine	Orlistat (Xenical)	Phentermine/ Topiramate ER (Qsymia)	Lorcaserin (Belviq)	Naltrexone SR/ bupropion SR (Contrave)	Liraglutide 3.0 mg (Saxenda)
Mechanism	Adrenergic agonist	Lipase inhibitor	Adrenergic agonist/ neurostabilizer	5-HT _{2C} receptor agonist	Opioid receptor antagonist/ dopamine and NE reuptake inhibitor	GLP-1 analog
Mean % weight loss (compared with placebo, ITT data)	5.1% at 28 weeks ¹⁰³ 15 mg daily	3.1% at 1 year ¹⁰⁴ 120 mg TID	6.6% at 1 year ¹⁰⁵ 7.5/46 mg daily	3.6% at 1 year ¹⁰⁶ 10 mg BID	4.8% at 56 weeks ¹⁰⁷ 16/180 mg BID	5.4% at 56 weeks ⁵³ 3 mg daily
Dosage/ administration	15 mg or 37.5 mg daily (can also use 1/4 or 1/2 pill)	120 mg TID with meals	3.75/23 mg daily with gradual dose escalation (7.5/46 mg daily, then 11.25/69 mg daily, then 15/92 mg daily)	10 mg BID	8/90 mg daily (AM) with dose escalation to (8/90 mg BID, then 16/180 mg in the morning, 8/90 mg in the evening, then 16/180 mg BID)	0.6 mg daily with escalation by 0.6 mg every week up to 3.0 mg daily
Available formulations	Capsule, tablet, powder	Capsule	Capsule	Tablet	Tablet	Prefilled pen for SC injection
Approved for long-term use?	No	Yes	Yes	Yes	Yes	Yes
Schedule IV controlled substance?	Yes	No	Yes	Yes	No	No
Side effects	Dizziness, dry mouth, difficulty sleeping, irritability, nausea/vomiting, diarrhea, constipation	Oily spotting, flatus with discharge, fecal urgency, fatty/oily stool, increased defecation, fecal incontinence	Paresthesia, dizziness, dysgeusia, insomnia, constipation, dry mouth	Headache, dizziness fatigue, nausea, dry mouth, constipation, hypoglycemia, back pain, cough, fatigue	Nausea, constipation, headache, vomiting, dizziness, insomnia, dry mouth, diarrhea	Nausea, hypoglycemia, diarrhea, constipation, vomiting, headache, dyspepsia, fatigue, dizziness, abdominal pain, increased lipase
Contraindications	Pregnancy, nursing, CVD, during or within 14 days of MAOIs, other sympathomimetic amines, hyperthyroidism, glaucoma, agitated states, history of drug abuse, concomitant alcohol use	Pregnancy, chronic malabsorption syndrome, cholestasis; should not be taken with cyclosporine, L-thyroxine, warfarin, or antiepileptic drugs	Pregnancy, glaucoma, hyperthyroidism, during or within 14 days of MAOIs, other sympathomimetic amines	Pregnancy; caution with valvular heart disease and other serotonergic drugs (co- administration may lead to serotonin syndrome or neuroleptic malignant syndrome)	Pregnancy, uncontrolled HTN, history of seizures or at risk of seizure, bulimia or anorexia, use of opioid agonists or partial agonists, during or within 14 days of MAOIs	Pregnancy, personal or family history of medullary thyroid carcinoma or multiple endocrine neoplasia syndrome type 2

NOTE. Adapted from Apovian CM, Aronne L, Powell AG.⁴⁵BID, twice daily; 5-HT_{2C}, serotonin; HTN, hypertension; ITT, intention-to-treat; MAOI, monoamine oxidase inhibitor; NE, norepinephrine; SC, subcutaneous; TID, 3 times daily.^aThese are summaries of manufacturer product information and should in no way replace guidance found in the package insert and/or updates provided by the manufacturer.

Orlistat (Xenical). Orlistat was approved by the FDA in 1999 for chronic weight management and remained the only FDA-approved weight loss medication for chronic use until 2012.⁴⁵ It is also available as an over-the-counter medication (Alli) at half the prescription dose.⁴⁷ Orlistat reduces fat absorption from the gastrointestinal tract by inhibiting pancreatic and gastric lipases. It blocks absorption of about 30% of ingested fat.⁴⁸ Although the gastrointestinal side effects associated with steatorrhea can limit patient tolerability and long-term use, orlistat can be an attractive medication for patients with obesity and constipation. The recommended dosage of orlistat is one 120-mg capsule (Xenical) or one 60-mg capsule (Alli) 3 times a day with each main meal containing fat. Patients should be advised to follow a diet with approximately 30% of calories from fat. In addition, patients should take a multivitamin to ensure adequate nutrition because orlistat decreases the absorption of fat-soluble vitamins (A, D, E, and K).

Phentermine/topiramate extended release (Qsymia). The fixed-dose combination of phentermine and topiramate ER was the first combination medication for chronic weight management approved by the FDA in 2012.⁴⁵ Targeting different sites simultaneously can have an additive effect on weight loss, addressing that obesity is a complex disorder that involves multiple signaling pathways. Topiramate, which was approved for epilepsy in 1996 and migraine prophylaxis in 2004, has been found to decrease caloric intake. The mechanism responsible for weight loss is thought to be mediated through its modulation of gamma-aminobutyric acid receptors, inhibition of carbonic anhydrase, and antagonism of glutamate to reduce food intake by decreasing appetite and increasing satiety.⁴⁹ Phentermine/topiramate ER is available in 4 doses, which should be taken once daily in the morning. Gradual dose escalation, which helps minimize risks and adverse events, should proceed as follows: initially 3.75/23 mg daily for 14 days and then 7.5/46 mg daily, and at 12 weeks the option to increase to 11.25/69 mg daily and then 15/96 mg daily.

The medication should be discontinued or the dose should be escalated if 3% weight loss is not achieved after 12 weeks at 7.5/46 mg daily or discontinued if 5% weight loss is not achieved after 12 weeks at 15/92 mg daily.

Lorcaserin (Belviq). The second medication approved by the FDA in 2012 for chronic weight management is lorcaserin.⁴⁵ It is a serotonin receptor agonist that is thought to reduce food intake and increase satiety by selectively activating receptors on anorexigenic pro-opiomelanocortin (POMC) neurons in the hypothalamus. At the recommended dose, lorcaserin selectively binds to 5-hydroxytryptamine (5-HT)_{2C} receptors instead of 5-HT_{2A} and 5-HT_{2B} receptors, which are associated with hallucinations and cardiac valve insufficiency, respectively.⁵⁰ The recommended dose of

lorcaserin is 10 mg twice daily. The medication should be discontinued if $\geq 5\%$ weight loss is not achieved after 12 weeks.

Bupropion/naltrexone sustained release (Contrave). Bupropion/naltrexone sustained release (SR) was approved by the FDA in 2014.⁴⁵ Bupropion is a dopamine/norepinephrine reuptake inhibitor approved for depression in the 1980s and smoking cessation in 1997. Naltrexone is an opioid receptor agonist approved for opiate dependency in 1984 and alcohol addiction in 1994. The 2 medications have a synergistic effect.⁵¹ The combination activates POMC neurons in the arcuate nucleus. This causes release of alpha-melanocyte-stimulating hormone (a potent anorectic neuropeptide), which projects to other hypothalamic areas involved in feeding and body weight control. Bupropion/naltrexone SR tablets contains 8 mg naltrexone and 90 mg bupropion. Initial prescription should be for 1 tablet daily, with instructions to increase by 1 tablet a week to a maximum dose of 2 tablets in the morning and 2 tablets in the evening (32/360 mg). The medication should be discontinued if a patient has achieved $\leq 5\%$ weight loss at 12 weeks.

Liraglutide (Saxenda). Liraglutide is a GLP-1 analogue with 97% homology to human GLP-1, a gut-derived incretin hormone.⁴⁵ Liraglutide was approved in 2010 for the treatment of T2DM at doses up to 1.8 mg daily. In phase III studies many patients on liraglutide for diabetes lost weight in a dose-dependent manner,⁵² and the efficacy was similar in patients with obesity without diabetes.⁵³ The FDA approved liraglutide in 2014 as Saxenda at 3.0 mg dose for chronic weight management in patients with obesity. Weight loss is mediated by reduced energy intake by reducing appetite, increasing satiety, and delaying gastric emptying.^{54,55} Liraglutide is administered as a subcutaneous injection once daily. It is initiated at 0.6 mg daily for 1 week, with instructions to increase by 0.6 mg weekly until 3.0 mg is reached. Slower dose titration is effective in managing gastrointestinal side effects. The medication should be discontinued if a patient has achieved $\leq 4\%$ weight loss at 16 weeks.

Bariatric Endoscopy

We recommend considering bariatric endoscopy in combination with lifestyle changes in patients who have been unable to lose or maintain weight loss with diet and exercise alone. Endoscopic weight loss procedures can assist in adherence to a reduced-calorie diet, and they can augment weight loss. They require an associated well-structured multidisciplinary weight loss program for success. In recent years, the FDA has approved 2 intragastric balloons and a gastric aspiration device for weight loss therapy. In addition, an endoscopic suturing device has been cleared by FDA and is being studied for use in endoscopic sleeve gastropasty procedures

Table 5. Overview of FDA-approved Bariatric Endoscopic Procedures

Name	Mechanism	TBWL (%)	Adverse effects*
Orbera intragastric balloon ⁵⁷	Gastric occupying space; delays gastric emptying	11.3% ^{a,59}	Nausea, fullness, 1% migration
Re-shape intragastric balloon ⁵⁶	Facilitate partial removal of gastric contents	7.9% ^{b,57}	Nausea, fullness
AspireAssist aspiration therapy	Restrictive procedure; delays gastric emptying	12.1% ^{a,61}	Less than 0.5% risk of peritonitis, ulceration, and abdominal pain
Endoscopic sleeve gastropasty ⁵⁸		20% ^{c,62}	Nausea, pain, reflux, risk of bleeding

NOTE. Intragastric balloon removed at 6 months and reported.

^aTBWL at 12 months.

^bTBWL at 9 months.

^cReported TBWL at 18 months.

(Table 5). There are a number of other endoscopic bariatric therapies currently being used internationally and in the FDA pipeline.⁵⁶ Currently, endoscopic bariatric therapies are not covered by most health insurance, with rare exception. The AGA is developing an episode payment framework to structure both the currently reimbursable and the fee portion of these interventions.

PRACTICE GUIDE: There are multiple hands-on meetings to get familiar with the procedure as well as the companies provide training on their own devices. Usually these procedures are performed under sedation with anesthesia support.

Intragastric Balloons

The Orbera, which is a single balloon filled with saline, and the Reshape Duo, which is a dual balloon system, were recently approved by the FDA. Both are available for 6-month implantation to treat obesity in appropriate patients in conjunction with comprehensive lifestyle modification and supportive follow-up.

The ReShape Duo is FDA-approved in patients with BMI 30–40 kg/m² and at least 1 obesity-related comorbidity. It consists of 2 spherical balloons connected by a flexible silicone rod. The device is deployed endoscopically, and the balloons are filled with methylene blue-tinted saline. If 1 balloon deflates, the other balloon is designed to prevent migration, and the patient is alerted by the presence of green urine. Approximately 900 mL saline is distributed between the 2 balloons. The Reshape Duo is removed endoscopically at 6 months. The REDUCE trial compared Reshape DUO with diet and lifestyle intervention alone. DUO patients had mean percentage of weight loss of 8.4% at 6 months and 7.5% at 9 months compared with the control group (n = 126), which had weight loss of 5.4% at 6 months and 4.6% at 9 months for the control group subjects. Balloon deflation occurred in 6% without migrations, and early retrieval for intolerance (unassociated with ulceration) occurred in 9%. Gastric ulcers were observed, and a minor device change led to significantly reduced ulcer size and frequency.⁵⁷ According to the FDA report indicating the

approval of ReShape Duo, a study of 326 patients across 8 investigational sites found that patients who received the device in addition to diet and exercise counseling lost an average of 14.3 pounds (6.8% of total body weight), whereas those who received the counseling alone lost 7.2 pounds (3.3% of total body weight).⁵⁸

The Orbera is a spherical, large-capacity silicone polymer device approved for treatment of patients with BMI 30–40 kg/m², with or without comorbidities. The deflated balloon comes preloaded on a catheter, which is blindly passed transorally into the esophagus followed by tandem passage of an endoscope to ensure accurate placement of the balloon in the fundus. Under direct endoscopic visualization, the device is inflated through the external port of the catheter with 400–700 mL saline. Methylene blue can be added to the saline so the patient can look for green urine as a sign that the balloon has deflated. The balloon is currently deployed for a maximum duration of up to 6 months and then deflated and extracted endoscopically. The Orbera device has the most robust published data of the gastric balloons and has been used in Europe for 2 decades. On the basis of a meta-analysis of 17 studies including 1683 patients, the pooled percentage of total body weight loss (TBWL) after Orbera intragastric balloon implantation was 12.3% (95% confidence interval [CI], 7.9%–16.73%), 13.16% (95% CI, 12.37%–13.95%), and 11.27% (95% CI, 8.17%–14.36%) at 3, 6, and 12 months after implantation, respectively.⁵⁹ Complications of intragastric balloons reported in a large case series and a meta-analysis include esophagitis (1.27%), gastric perforation (0.1%), gastric outlet obstruction (0.76%), gastric ulcer (0.2%), balloon rupture (0.36%), and death (0.07%).⁵⁹ According to the FDA report indicating the approval of the Orbera device, patients who received Orbera lost an average of 21.8 pounds (10.2% of total body weight) in 6 months and maintained a loss of 19.4 pounds 3 months after device removal. Participants in the control group lost an average of 7.0 pounds (3.3% of total body weight).⁶⁰

Aspiration Therapy

The AspireAssist Aspiration Therapy System was recently approved by the FDA in patients at least 22

years of age with BMI of 35.0–55.0 kg/m² who have failed nonsurgical weight loss therapy. The device is approved for long-term use in conjunction with lifestyle therapy and longitudinal medical monitoring. The system consists of an endoscopically placed percutaneous gastrostomy device (A-tube) and a skin port with a counter that deactivates the device after a standard number of uses, necessitating a return visit for dietary counseling at regular intervals. The system includes an attachable aspiration accessory with a water-filled reservoir that permits instillation of fluid into the stomach to facilitate partial removal of gastric contents.

The randomized controlled pivotal study included 171 subjects at 10 centers; 111 were in the device arm and 60 in the control arm. All participants received diet and exercise counseling. The device was used in treatment subjects up to 3 times per day, approximately 20–30 minutes after meals. After 52 weeks, subjects in the device arm lost an average of 31.2 pounds (12.1% total weight loss), and the control group lost an average of 9.0 pounds (3.5% total weight loss).⁶¹

There were 5 device-related severe adverse events, including peritonitis requiring antibiotics, ulceration requiring device repositioning, and abdominal pain requiring medical management. The system discourages binge eating, because it requires excessive mastication to prevent occlusion of the device with food debris, and it mandates regular dietary counseling for continued use. Improved eating habits were reported in the majority of treatment subjects.

Endoscopic Sleeve Gastroplasty

Endoscopic sleeve gastroplasty is an endoscopic gastric volume reduction technique that creates a sleeve-like tubularized conduit in a fashion similar but not identical to sleeve gastrectomy.⁵⁶ By using an FDA-approved and commercially available endoscopic suturing device (Overstitch; Apollo Endosurgery, Austin, TX), a series of full-thickness sutures are endoluminally placed through the gastric wall, extending from the prepyloric antrum to the gastroesophageal junction, creating a sleeve by reducing the greater curve. Full-thickness suture placement is aided by the use of a tissue helix device that captures the targeted suture placement site on the gastric wall and retracts it into the suturing arm of the device. In a multicenter clinical trial of 242 patients, the total weight loss was 16.8% ± 6.4% at 6 months, 18.2% ± 10% at 1 year, and 19.8% ± 11.6% at 18 months. The endoscopic sleeve gastroplasty was associated with 2% serious adverse events that occurred: 2 perigastric inflammatory fluid collections (adjacent to the fundus) that resolved with percutaneous drainage and antibiotics, 1 self-limited hemorrhage from splenic laceration, 1 pulmonary embolism 72 hours after the procedure, and 1 pneumoperitoneum and pneumothorax requiring chest tube placement. All 5 patients recovered fully.⁶² Endoscopic sleeve gastroplasty is a

new procedure with limited published data, and initial follow-up of the first 250 cases is ongoing.

Transoral Outlet Reduction

Although Roux-en-Y gastric bypass achieves substantial and durable weight loss in many patients, a significant minority of patients have clinically meaningful weight regain. In an effort to reduce weight gain, transoral outlet reduction (TORe) uses an endoscopic suturing device to reduce the gastrojejunal anastomotic aperture by placement of an interrupted or purse-string suture around the anastomosis. TORe was the first endoscopic suturing procedure performed to treat obesity (2004) and is currently the most commonly performed endoscopic suturing procedure in the United States. The procedure was evaluated in a multicenter, double-blind, randomized, sham-controlled trial (RESTORE).⁶³ The primary outcome was difference in weight loss between the treatment and sham groups with intent-to-treat analysis at 6 months. Seventy-seven subjects were randomized; 50 received TORe, and 27 received sham treatment. The primary end point was met with weight loss of 3.5 kg in the TORe arm vs 0.4 kg in the sham ($P = .021$). This trial used an impermanent suturing device, leading to questions of long-term durability.

More recently, a larger uncontrolled series used an FDA-approved commercially available full-thickness suturing device (Overstitch; Apollo Endosurgery) to assess the longer-term durability of TORe.⁶⁴ Among 150 patients who underwent TORe by using this device, there was a mean of 8.4 kg weight loss and 18.8% excess weight loss at 3 years. In both studies more than 90% of subjects who were actively gaining weight after Roux-en-Y bypass had cessation of weight gain after TORe.

Transient pharyngeal pain, epigastric pain, nausea, and vomiting were frequently reported. More rare was ulceration, with self-limited bleeding. Severe complications are rare, with no report of leaks, need for surgery, or mortality in these studies.

Bariatric Surgery

Bariatric surgery is proven to be safe and the most efficacious and durable treatment of severe obesity and significant weight-related comorbid diseases.^{65–67} According to National Institutes of Health consensus criteria, patients with severe obesity BMI ≥40 kg/m² or 35 kg/m² with 1 comorbidity who have failed attempts at medical weight loss and are without a history of psychological and substance abuse are candidates for surgical intervention. Long-term success of surgical procedures is often related to patient follow-up and participation in a comprehensive lifestyle program.^{68,69}

Long-term studies assessing the weight loss outcomes of bariatric surgery have demonstrated improvement in

all-cause survival as expressed in improved mortality compared with cohorts with severe obesity and weight-related disease that did not undergo surgical intervention.^{66,70} In addition to weight loss, diseases of the metabolic syndrome including diabetes, hypertension, and hypertriglyceridemia as well as obstructive sleep apnea have been shown to improve or resolve in many patients who underwent bariatric surgery.⁷¹ In addition, other obesity-related diseases that improve include NAFLD, GERD, polycystic ovary syndrome, degenerative joint disease, pseudotumor cerebri, and CVD.

In 2013, approximately 190,000 bariatric operations were performed in the United States, and 350,000 were performed worldwide. Overall, perioperative mortality for bariatric surgery ranges from 0.1% to 0.3%.⁷² Perioperative and nutritional deficiencies are overall low but vary widely according to procedure (Appendix 9). Long-term data have demonstrated success of laparoscopic bariatric surgery in terms of both durable excess weight loss and improvement in weight-related medical diseases.^{65,66,73} In addition, perioperative and long-term safety evaluations have demonstrated low rates of minor and major complications, when performed by experienced surgeons in a comprehensive bariatric treatment center.⁷⁴ In addition, patients who undergo bariatric surgery are frequently in their reproductive years. It is generally suggested that women who choose to undergo bariatric surgery should wait at least a year after surgery to become pregnant to minimize nutrition-related and other health risks to mother and infant.

The 3 most commonly performed laparoscopic operations in the United States currently are laparoscopic sleeve gastrectomy, laparoscopic Roux-en-Y gastric bypass, and laparoscopic adjustable gastric banding, respectively. Recently, the laparoscopically reversible vagal nerve blockade (V-Bloc) was approved for the treatment of obesity.⁷⁵⁻⁷⁹ The vagal nerve blockade produced a mean 9.2% of their initial body weight loss vs 6.0% initial body weight loss in the sham group at 1 year after procedure. The most common adverse events were heartburn or dyspepsia and abdominal pain.⁷⁸

Laparoscopic Sleeve Gastrectomy

The most commonly performed procedure currently is sleeve gastrectomy that removes from two-thirds to three-fourths of the stomach, leaving a tubularized conduit that is based on the lesser curvature. The laparoscopic operation is restrictive in that the remaining stomach has diminished capacity, resulting in early fullness, but removal of the fundus also exerts a hormonal influence likely mediated by ghrelin. The TBWL is reported as 25% (excess weight loss, 38%–79%), with concomitant improvement in weight-related comorbid conditions.⁸⁰ Contraindications to performing sleeve gastrectomy are few. Relative contraindications include established Barrett's esophagus and refractory GERD. Complication rates are low and include stenosis and

staple line dehiscence, which occurs in <1% to 2.7% of cases. Longer-term complications such as chronic GERD, esophagitis, and the development of Barrett's esophagus must be better understood.

Laparoscopic Roux-en-Y Gastric Bypass

Until recently laparoscopic Roux-en-Y gastric bypass was the most commonly performed bariatric operation in the United States. The operation results in creation of a small gastric pouch that is based on the lesser curve and cardia of the stomach. The remaining stomach is left in place, and a Roux limb of mid-jejunum is created and anastomosed to the gastric pouch. The result is not only bypass of the remnant stomach but also the duodenum and proximal jejunum. The Roux limb constitutes the alimentary channel, and the biliopancreatic limb transports bile and pancreatic enzymes distally. These limbs converge at the surgical jejunojejunostomy anastomosis. Mixing of food with digestive enzymes occurs distal to the convergence of these 2 limbs in the area termed the common channel. The effectiveness of Roux-en-Y gastric bypass is likely multifactorial as a mixed restrictive and malabsorptive procedure. The small gastric pouch imparts restriction, and metabolic effects are likely hormonally mediated by bypassing the duodenum and pancreatic outflow. Excess weight loss is typically more than with sleeve gastrectomy, reportedly from 50% to 80% excess weight loss (25%–45% total weight loss), with demonstrated improvements specifically in metabolic diseases, especially diabetes, as well as other obesity-related diseases.^{67,71,73} Contraindications include history of inflammatory bowel disease and disease states that potentially could be affected by altered absorption (eg, post-organ transplantation requiring immunosuppression medications).

Adjustable Gastric Banding

Adjustable gastric banding was previously a popular procedure commonly performed for treatment of obesity. Performed laparoscopically, the procedure involves placement of a soft silicone ring just distal to the esophagogastric junction (Figure 3). The ring includes a balloon that can be filled intermittently to induce fullness and satiety without complete obstruction. Access to the balloon is by means of a needle percutaneously through a subcutaneously placed port. Excess weight loss is reported to be from 42% to 59% with wide variability⁸¹ (approximately 15%–20% total weight loss). Although perioperative complication rates are low, long-term complications of varying degrees are higher and have decreased widespread use of adjustable gastric banding. Reoperation has been reported in 20% of patients. Contraindications to adjustable gastric banding include large hiatal hernia, severe GERD, and esophageal motility disorders. The adjustable gastric banding placements are

decreasing because of durability of weight loss and side effects.

After bariatric surgery, patients are strongly encouraged to follow up in the same comprehensive management program. The goals are continued patient monitoring and management of weight-related diseases from the immediate postoperative period, through the time of maximal weight loss, and into the maintenance period. Typically, general and nutritional lab tests are drawn at 6 months and 1 year postoperatively and at yearly intervals thereafter.

PRACTICE GUIDE FOR PHYSICIANS: Although successful and durable for most patients, weight regain after bariatric surgery occurs. Endoscopic interventions and/or use of medications may be used to prevent further weight regain. At least yearly follow-up is needed to assess for weight regain and exclude nutrient, vitamin, or micronutrient deficiencies (Appendix 9). Patients having surgery or endoscopic procedures will need to be educated about the specific diet changes that must be made to accommodate the procedure. The patient's knowledge of the diet should be assessed as well to ensure comprehension of the guidelines.

Special Population: Child and Adolescent Obesity

This section discusses ways that pediatric obesity assessment and intervention differ from adult obesity care. More comprehensive reviews of childhood obesity are available.^{82,83}

Clinical Measure of Obesity

Assessment of excess weight is based on BMI percentiles because BMI distribution changes with age and gender throughout childhood. On the basis of data obtained from early 1960s to the mid-1990s, BMI between 85th and 94th percentiles is considered overweight, and BMI \geq 95th percentile defines obesity.⁸⁴ Currently 17.0% of children aged 2–19 years have BMI in the obese category.⁹ The degree of obesity correlates with prevalence of cardiometabolic risk factors.⁵ Several definitions of severe obesity are used including BMI \geq 120% of the obesity cutpoint for that child's age and gender.⁸⁵ Electronic health record programs automatically calculate and plot BMI percentile. Hardcopy growth curves are available (cdc.gov/growthcharts/cdc_charts.htm).

Assessment of Medical Comorbidities

Children with obesity should be assessed for cardiovascular risks factors, which are common. Blood pressure measures should be compared with norms for gender, age, and height that are published by National

Heart, Lung and Blood Institute.⁸⁶ Lipids should be screened starting at age 2 years if obesity is present, with abnormal values confirmed 2 weeks to 3 months after the initial screen.⁸⁷ Fasting glucose will screen for diabetes starting at age 10 years for children with obesity and 2 other diabetes risk factors.⁸⁸ NAFLD is increasing and has a prevalence of 9% among all children, with significantly higher risk among older children and children with obesity.⁸⁹ Upcoming NASPGHAN guidelines recommend screening children with obesity aged 9–11 years for NAFLD, coincident with lipid and diabetes screening (personal communication). Recommendations from an expert committee on child and adolescent obesity suggest screening children with obesity starting at 10 years, coincident with diabetes screening.⁸³ Screening in younger children may be appropriate when risk is high, although no specific algorithm for defining high risk has been proposed. In addition to metabolic comorbidities, children with obesity are at risk for obstructive sleep apnea and orthopedic pathology (Appendix 10).

Psychosocial Issues

Children and adolescents with obesity are at risk for depression and poor self-esteem, similar to adults. Young people have particular risk of being bullied, regardless of demographics or social and academic standing.⁹⁰

Importance of Family in Child and Adolescent Obesity

Parents can control the food and the electronic “screen” environment, especially the environment of younger children. Consistent evidence demonstrates that parent involvement in child weight management programs, especially if the program focuses on both the weight of the parent and the weight of the child, improves success.^{88,91–93} However, parents must be motivated and have time and resources for children to participate in any weight management programs.

Evidence Base for Behavioral Interventions

Several meta-analyses have demonstrated short-term (6–12 months) benefit of multicomponent programs of moderate to high intensity. Multicomponent means that diet, physical activity, and behavior changes strategies are all addressed. Moderate to high intensity means at least 25 hours and up to 75 hours of contact during a period of 6 months.⁹⁴ More studies are emerging.

Dietary Recommendations for Children

The MyPlate method is the core approach to healthy eating for the entire family. This approach incorporates low added sugar, moderate and balanced types of fat,

adequate dairy, appropriate whole grains, proteins, fruits and vegetables, and appropriate portion size. Eliminating sugar-sweetened beverages can lead to marked reductions in daily caloric intake and improve weight, at least in the short term.⁹⁵ Rapid weight loss can lead to delay in linear growth, and therefore highly restrictive diets are rarely appropriate for preadolescents.

Physical Activity

All children should be engaged in a total of 60 minutes of moderate to vigorous activity each day.⁹⁶ Physical education in schools is often not offered daily. Unstructured play can provide an effective and fun mechanism for physical activity and in fact is the preferred method of exercise in the preschool and early elementary child, who will be naturally active in intermittent spurts. This kind of activity requires safe play space and adult supervision, which are not always available. The older child can participate on sports teams or noncompetitive activities such as dance or martial arts. Children and adolescents will often experience targeted exercise such as treadmills or outdoor jogging as boring or even punitive. Activity-oriented video games result in less energy expenditure than actual sports but may be a compromise between ideal activity levels and safety concerns.

Weight and Body Mass Index Outcomes

Because of linear growth, younger children and those with mild obesity who maintain weight for 6 months or a year or who gain weight more slowly can in fact “grow into” a healthier BMI category. Adolescents who have finished linear growth and children with severe obesity will have health benefits from gradual weight loss.

Medication Options

The only weight control medication currently approved for children is orlistat, available for children at age 12 years and older, and studies have shown modest efficacy.⁹⁷ However, it is likely that studies of the newer adult medications, including phentermine/topiramate ER, lorcaserin, naltrexone SR/bupropion SR, and liraglutide, will be evaluated in adolescents for efficacy and safety.

Bariatric Surgery

Gastric bypass, sleeve gastrectomy, and laparoscopic banding bariatric procedures have all been evaluated in adolescents. A multicenter study of gastric bypass and sleeve gastrectomy demonstrated good outcomes and a favorable complication rate.⁹⁸ Several multidisciplinary panels have agreed on selection criteria. Potential patients must have BMI ≥ 35 kg/m² with a serious

comorbidity such as obstructive sleep apnea or have BMI ≥ 40 kg/m² with a chronic comorbidity. In addition, patients must be physically and emotionally mature, participate in a structured weight management program for 6 months before proceeding with surgery, have the support at home, and be cognitively unimpaired to give informed assent.^{99,100}

Conclusion

Obesity is possibly the greatest health care issue of our day. It is a chronic, relapsing, multifactorial disease, and successful treatment requires a continuum of care model. Although lifestyle changes, including an individualized reduced-caloric diet and physical activity, are the cornerstones of treatment, new medications and bariatric endoscopic therapies and surgery can be effective tools to help patients with obesity achieve realistic goals. Gastroenterologists are uniquely poised to enter the multidisciplinary realm of obesity therapy as internists, endoscopists, specialists in digestive disorders, and above all, physicians caring for people with obesity-related disease. Thus, the AGA recommends the POWER program as a guide for the successful implementation of comprehensive care of patients with obesity in an endoscopic bariatric practice by using a multidisciplinary approach.

Supplementary Material

Note: To access the supplementary material accompanying this article, visit the online version of *Clinical Gastroenterology and Hepatology* at www.cghjournal.org, and at <http://dx.doi.org/10.1016/j.cgh.2016.10.023>.

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Conflicts of interest

These authors disclose the following: Dr Acosta is a stockholder of Gila Therapeutics, Inc and serves on the scientific advisory board or board of directors of Gila Therapeutics, Inversago, and General Mills. Dr Cheskin is chair of the scientific advisory board of Medifast, Inc, and the medical advisory board of Pressed Juicery. Dr Kroh is a consultant for Medtronic, Cook Medical, Teleflex Medical, and Levita Magnetics. Dr Aronne is a consultant/advisory boards for Jamieson Labs, Pfizer, Inc, Novo Nordisk A/S, Eisai, GI Dynamics, Real Appeal-United Health Ventures, Gelesis; shareholder of Zafgen, Gelesis, Myos Corp, Jamieson Labs; and board of directors for MYOS Corp, Jamieson Labs Research Funding Aspire Bariatrics, Eisai, and Astra Zeneca. The remaining authors disclose no conflicts.

Appendix 1. Quantified Risk Ratios of Gastrointestinal Disorders in Obesity

Gastrointestinal disease	Obesity as risk factor		Reference
	Risk (OR or RR)	CI	
Esophagus			
GERD	OR, 1.94	95% CI, 1.46–2.57	108
Erosive esophagitis	OR, 1.87	95% CI, 1.51–2.31	109
Barrett's esophagus	OR, 4.0	95% CI, 1.4–11.1	110
Esophageal adenocarcinoma	Men: OR, 2.4 Women: OR, 2.1	95% CI, 1.9–3.2 95% CI, 1.4–3.2	111
Stomach			
Erosive gastritis	OR, 2.23	95% CI, 1.59–3.11	112
Gastric cancer	OR, 1.55	95% CI, 1.31–1.84	113
Small intestine			
Diarrhea	OR, 2.7	95% CI, 1.10–6.8	114
Colon and rectum			
Diverticular disease	RR, 1.78	95% CI, 1.08–2.94	115
Polyps	OR, 1.44	95% CI, 1.23–1.70	116
Colorectal cancer	Men: RR, 1.95 Women: RR, 1.15	95% CI, 1.59–2.39 95% CI, 1.06–1.24	117
Liver			
NAFLD	RR, 4.6	95% CI, 2.5–11.0	118
Cirrhosis	RR, 4.1	95% CI, 1.4–11.4	119
Hepatocellular carcinoma	RR, 1.89	95% CI, 1.51–2.36	120
Gallbladder			
Gallstones disease	Men: RR, 2.51 Women: RR, 2.32	95% CI, 2.16–2.91 95% CI, 1.17–4.57	12
Pancreas			
Acute pancreatitis	RR, 2.20	95% CI, 1.82–2.66	121
Pancreatic cancer	Men: RR, 1.10 Women: RR, 1.13	95% CI, 1.04–1.22 95% CI, 1.05–1.18	122

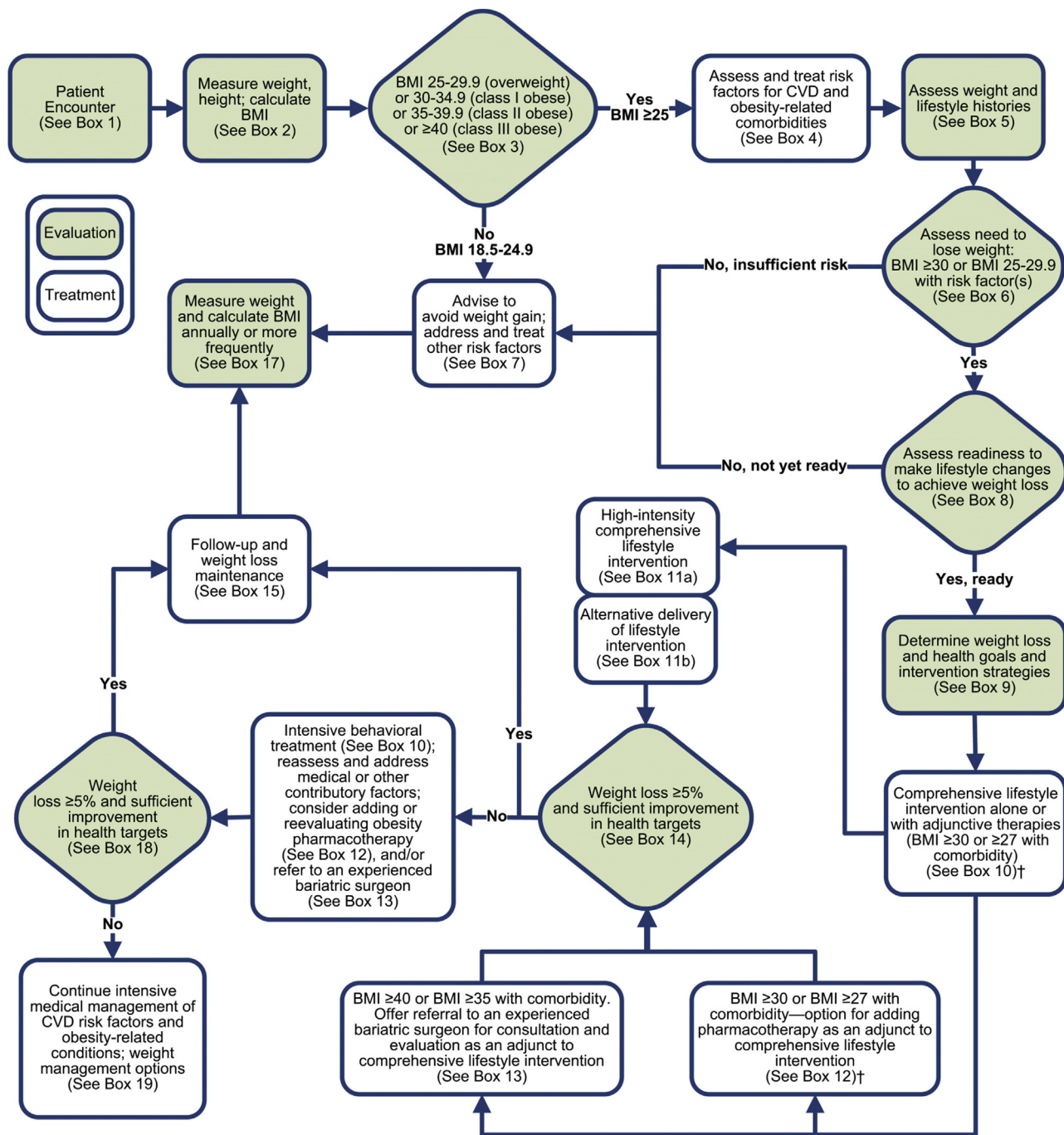
NOTE. Adapted from Acosta and Camilleri.²⁸
OR, odds ratio; RR, relative risk.

Appendix 2. List of Medications Associated With Weight Gain, Weight Neutrality, and Weight Loss

	Weight gain	Weight neutrality	Weight loss
Antidepressants	Amitriptyline, imipramine Citalopram Doxepin Fluoxetine (>1 y) Mirtazapine Nortriptyline Paroxetine Phenelzine Sertraline (>1 y)	Bupropion Fluoxetine (<1 y) Nefazodone Sertraline (<1 y)	Bupropion
Antidiabetics	Insulin Sulfonylureas (eg, glyburide) Thiazolidinediones (eg, rosiglitazone, pioglitazone)	Acarbose α -glucosidase inhibitors DPP-4 inhibitors Miglitol	Glimepiride GLP-1 agonists (eg, exenatide, liraglutide) Metformin Pramlintide SGLT2 inhibitors DPP4 inhibitors (eg, sitagliptin, vildagliptin)
Antiepileptics	Carbamazepine Gabapentin, pregabalin Valproic acid Vigabatrin	Lamotrigine Levetiracetam Phenytoin	Felbamate Topiramate Zonisamide
Antihistaminics	Cyproheptadine, diphenhydramine, meclizine		
Antihypertensives	Doxazosin, prazosin, terazosin Metoprolol, propranolol	Carvedilol Nebivolol	
Antipsychotics	Clozapine, olanzapine, quetiapine Lithium Perphenazine Risperidone	Aripiprazole Ziprasidone	
Contraceptives and hormones	Depo-medroxyprogesterone acetate Megestrol acetate		
Steroids	Corticosteroids (eg, prednisone) Glucocorticoids Progestins		

NOTE. Adapted from Apovian CM, Aronne L, Powell AG. Clinical management of obesity. West Islip, NY: Professional Communications, Inc, 2015:186–192. DPP-4, dipeptidyl peptidase-4; SGLT2, sodium-glucose co-transporter 2.

Appendix 3. 2013 AHA/ACC/TOS Guideline for the Management of Overweight and Obesity in Adults: A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines and The Obesity Society



web 4C/FPO

Appendix 4. Epworth Sleepiness Scale

Epworth Sleepiness Scale

Name: _____ Today's date: _____

Your age (Yrs): _____ Your sex (Male = M, Female = F): _____

How likely are you to doze off or fall asleep in the following situations, in contrast to feeling just tired?

This refers to your usual way of life in recent times.

Even if you haven't done some of these things recently try to work out how they would have affected you.

Use the following scale to choose the **most appropriate number** for each situation:

- 0 = would **never** doze
- 1 = **slight chance** of dozing
- 2 = **moderate chance** of dozing
- 3 = **high chance** of dozing

It is important that you answer each question as best you can.

Situation	Chance of Dozing (0-3)
Sitting and reading _____	
Watching TV _____	
Sitting, inactive in a public place (e.g. a theatre or a meeting) _____	
As a passenger in a car for an hour without a break _____	
Lying down to rest in the afternoon when circumstances permit _____	
Sitting and talking to someone _____	
Sitting quietly after a lunch without alcohol _____	
In a car, while stopped for a few minutes in the traffic _____	

THANK YOU FOR YOUR COOPERATION

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Appendix 5. STOP BANG Sleep Apnea Screening Questionnaire

STOP BANG

This is a revision of the popular STOP BANG sleep apnea screening questionnaire (Luo J, Huang R, Zhong X, et al. Chinese Medical Journal 2014;127:1843–1848. Available at: https://www.sleepmedicine.com/files/files/StopBang_Questionnaire.pdf.) The scoring system is at the bottom.

Do you SNORE loudly? Yes or No

Do you often feel tired, fatigued, or sleepy during the daytime? Yes or No

Has anyone observed you stop breathing during your sleep? Yes or No

Do you have or are you being treated for high blood pressure? Yes or No

Are you obese/very overweight—BMI more than 35 kg/m²? Yes or No

Age older than 50 years? Yes or No

Neck circumference >16 inches? Yes or No

Are you male? Yes or No

SCORE:

If YES to 0–2, then low risk of sleep apnea.

If YES to 3–4 of the above, then you are at intermediate risk of having sleep apnea.

If YES to 5–8 of the above, then you are at high risk of having sleep apnea.

Appendix 6. Instructions, 8-Items, and Likert Scale for the Short-Form of the Weight Efficacy Lifestyle Questionnaire

Weight Efficacy Lifestyle Questionnaire Short-Form (WEL-SF)

Read each situation below and decide how confident (or certain) you are that you will be able to resist overeating in each of the difficult situations. On a scale of 0 (not confident) to 10 (very confident), choose ONE number that reflects how confident you feel now about being able to successfully resist the desire to overeat. Write this number next to each item.

0	1	2	3	4	5	6	7	8	9	10
Not at all										Very
confident										confident

I AM CONFIDENT THAT:

1. I can resist overeating when I am anxious (or nervous).

2. I can resist overeating on the weekend.

3. I can resist overeating when I am tired.

4. I can resist overeating when I am watching TV (or using the computer).

5. I can resist overeating when I am depressed (or down).

6. I can resist overeating when I am in a social setting (or at a party).

7. I can resist overeating when I am angry (or irritable).

8. I can resist overeating when others are pressuring me to eat.

Confidence number

Appendix 7. Multidisciplinary Team^{5,123}

Physicians

- Obesity medicine specialists
- Gastroenterologists
- Bariatric surgeons
- Endocrinologists
- Primary care providers
- Other physicians including family medicine providers, sleep medicine specialists, pulmonologists, cardiologists, gynecologists, anesthesiologists, radiologists

Registered dietitian nutritionists

Exercise specialists

Psychologists, psychiatrists, and other behavioral health professionals

Physician assistants, nurse practitioners, nurses

Health counselors, social workers

Professionals in training

For more information refer to Blackburn GL, et al. The Multidisciplinary Approach to Weight Loss: Defining the Roles of the Necessary Providers. Available at: <http://bariatrictimes.com/the-multidisciplinary-approach-to-weight-loss-defining-the-roles-of-the-necessary-providers/>

Appendix 8. Community Resources and Helpful Links

Societies/Professional Organizations

Academy of Nutrition and Dietetics

- The Academy of Nutrition and Dietetics is the world's largest organization of food and nutrition professionals. The Academy is committed to improving the nation's health and advancing the profession of dietetics through research, education, and advocacy. The Academy includes specialty practice groups, including the Weight Management Dietetic Practice Group.

- www.eatrightpro.org
- www.wmdp.org

American Board of Obesity Medicine (ABOM)

- Medical board that serves the public and the field of obesity medicine by maintaining standards for assessment and credentialing physicians; certification as an ABOM diplomate signifies specialized knowledge in the practice of obesity medicine and distinguishes a physician as having achieved competency in obesity care.

- abom.org

American Gastroenterological Association (AGA)

- Society of gastroenterologists established to advance the science and practice of gastroenterology

- gastro.org

American Society for Gastrointestinal Endoscopy (ASGE)

- Society of physicians with highly specialized training in endoscopic procedures of the digestive tract dedicated to advancing patient care and digestive health by promoting excellence and innovation in gastrointestinal endoscopy

- asge.org

American Society for Metabolic and Bariatric Surgery (ASMBS)

- Society of metabolic and bariatric surgeons who strive to improve public health and well-being by lessening the burden of the disease of obesity and related diseases throughout the world

- asmbs.org

Obesity Medicine Association (OMA)

- Society of clinical leaders in obesity medicine who work to advance the prevention, treatment, and reversal of the disease of obesity

- obesitymedicine.org

Obesity Action Coalition

- It is the major patient driven, patient advocacy organization.

- <http://www.obesityaction.org/>

Society of American Gastrointestinal and Endoscopic Surgeons (SAGES)

- Society of American gastrointestinal and endoscopic surgeons designed to improve quality patient care through education, research, innovation, and leadership, principally in gastrointestinal and endoscopic surgery

- sages.org

The Obesity Society (TOS)

- Society of Obesity Medicine specialists created to lead the charge in advancing the science-based understanding of the causes, consequences, prevention, and treatment of obesity

- obesity.org

World Obesity Federation

- Organization of professional members of the scientific, medical, and research communities from more than 50 regional and national obesity associations with the goal of leading and driving global efforts to reduce, prevent, and treat obesity

- worldobesity.org

Resources

The Academy of Nutrition and Dietetics also has weight management tools and resources at www.eatright.org and www.eatrightstore.org.

Academy of Nutrition and Dietetics "Find an Expert" service on the website to search a national database of Academy members for the exclusive purpose of finding a qualified registered dietitian nutritionist or food and nutrition practitioner. <http://www.eatright.org/find-an-expert>

BMIQ Professionals Program

- Comprehensive medical weight loss program designed for health care professionals to deliver in a variety of settings

- bmiq.com

Division of Nutrition, Physical Activity, and Obesity, Centers for Disease Control and Prevention (CDC)

- Division of the CDC that works with state and local partners on community solutions to help increase healthy food choices and connect people to places and opportunities where they can be regularly active

- <http://www.cdc.gov/nccdphp/dnpao/>

Jenny Craig^a

- Commercial weight loss program

- jennycraig.com

Nutrition.gov

- Website providing access to vetted food and nutrition information from across the federal government

- nutrition.gov
-

Appendix 8. Continued

Physician and Patient Resources on Obesity Management and Prevention, American Medical Association (AMA)

- Resources for patients and healthcare professionals to prevent and manage obesity
- <http://www.ama-assn.org/ama/pub/about-ama/our-people/member-groups-sections/resident-fellow-section/rfs-resources/public-health-resources/obesity-resources.page>

Optifast^a

- Commercial weight loss program
- optifast.com

Medifast^a

- Commercial weight loss program
- medifast.com

Weight Management Tools and Resources, National Heart, Lung and Blood Institute

- Resources for patients to manage a healthy weight (NHLBI)
- <http://www.nhlbi.nih.gov/health/educational/wecan/tools-resources/weight-management.htm>

Weight Watchers^a

- Commercial weight loss program
- weightwatchers.com

^aData from clinical trials that lasted at least 12 months illustrated that program participants had a greater weight loss than nonparticipants. Gudzone, KA, et al. Efficacy of Commercial Weight-Loss Programs: An Updated Systematic Review. *Ann Intern Med* 2015;162:501–512.

Appendix 9. Bariatric Surgery Complications Including Nutrient, Vitamin, or Micronutrient Deficiencies

Procedure-independent Complications of Bariatric Surgery

Early complications

- Surgical site infection (superficial, deep)
- Bleeding (gastrointestinal, intraperitoneal)
- Pulmonary complications (airway obstruction, atelectasis, pneumonia, pneumothorax, respiratory failure)
- Deep vein thrombosis and pulmonary embolism
- Nausea and vomiting, food intolerance, dehydration
- Prolonged postoperative ileus
- Cardiac arrhythmia (induced by hypoxia)
- Myocardial infarction
- Dehiscence and evisceration
- Rhabdomyolysis (due to pressure necrosis of the gluteal and shoulder muscles), acute tubular necrosis
- Pancreatitis
- Sepsis and multiple organ failure

Late complications

- Intractable nausea and vomiting, food intolerance, dehydration
- Intestinal obstruction (due to intraluminal clot, adhesion, abdominal wall hernia)
- Incisional hernia
- Weight loss failure
- Weight regain
- Nutritional deficiencies
- Hypoglycemia

Procedure-specific Complications of Bariatric Surgery

Procedure	Early complications	Late complications
Laparoscopic adjustable gastric banding	<ul style="list-style-type: none"> • Gastroesophageal reflux • Band misplacement • Band slippage 	<ul style="list-style-type: none"> • Gastroesophageal reflux • Pouch enlargement, esophageal dilation • Gastric prolapse • Band slippage • Mechanical port and tubing complications • Band erosion into the stomach • Necessity for multiple adjustments
Laparoscopic sleeve gastrectomy, laparoscopic gastric plication	<ul style="list-style-type: none"> • Gastrointestinal leak (generalized peritonitis, abscess, fistula formation) • Gastric obstruction • Gastroesophageal reflux 	<ul style="list-style-type: none"> • Gastroesophageal reflux • Gastric dilation
Roux-en-Y gastric bypass	<ul style="list-style-type: none"> • Gastrointestinal leak (generalized peritonitis, abscess, fistula formation) • Acute distal gastric dilatation and rupture • Roux limb obstruction 	<ul style="list-style-type: none"> • Stomal stenosis (at gastrojejunostomy) • Marginal ulcer (at gastrojejunostomy) • Dumping syndrome • Internal hernia • Staple line disruption and gastrogastic fistula • Stomal dilation • Gallstone • Nutritional deficiencies (calcium, iron, vitamin D, and B₁₂)

Possible Nutritional Deficiencies After Bariatric Surgery

- Iron
- Vitamin B₁₂
- Folate
- Thiamine
- Calcium
- Vitamins A, C, D, E, K
- Zinc
- Copper
- Selenium
- Protein

NOTE. Tables adapted from Aminiam A, Schauer PR.³

Appendix 10. Considerations for Evaluation and Treatment of Children and Adolescents With Obesity

Condition	Screening procedures. Abnormal values should prompt additional evaluation before diagnosis
Cardiovascular	Blood pressure (3 separate readings BP >95% age, height, sex ⁸⁶)
Hypertension	Fasting lipids age 2 years and older if obesity present:
Hyperlipidemia	(total cholesterol >170 mg/dL, LDL cholesterol >110 mg/dL, triglycerides >100 mg/dL, HDL cholesterol >45 mg/dL) ¹²⁴
Endocrinologic	Clinical and laboratory evaluation
Diabetes/insulin resistance	Fasting glucose age 10 years with risk factors: diabetes ≥126 mg/dL, impaired 100–126 mg/dL ⁸⁸ 2-hour oral glucose tolerance test: diabetes >200 mg/dL, impaired 140–200 mg/dL
NAFLD	Age 10 years ALT and AST > gender-specific norms of 22 U/dL for girls and 26 U/dL for boys
Orthopedic	Blount's: screen with visual exam for bowing. May cause no pain.
Blount's disease	SCFE = hip/knee pain, decreased internal rotation of hip, may progress to inability to bear weight/decreased range of motion
Slipped capital femoral epiphysis (SCFE)	
Sleep	Snoring, pauses in breathing during sleep, daytime somnolence: assess with sleep study
Obstructive sleep apnea	

ALT, alanine aminotransferase; AST, aspartate aminotransferase; BP, blood pressure; HDL, high-density lipoprotein; LDL, low-density lipoprotein.

Appendix 11. Change in Obesity-related Comorbidities After Roux-en-Y Procedure

Table 8. CHANGE IN OBESITY-RELATED COMORBIDITY

Comorbidity	Total	% Aggravated	% Unchanged	% Improved	% Resolved
OA/DJD	64	2	10	47	41
Hypercholesterolemia	62	0	4	33	63
GERD	58	0	4	24	72
HTN	57	0	12	18	70
Sleep apnea	44	2	5	19	74
Hypertriglyceridemia	43	0	14	29	57
Depression	36	8	37	47	8
Peripheral edema	31	0	4	55	41
Urinary incontinence	18	0	11	39	44
Asthma	18	6	12	69	13
Diabetes	18	0	0	18	82
Migraine headaches	7	0	14	29	57
Anxiety	7	0	50	17	33
Venous insufficiency	7	0	71	29	0
Gout	7	0	14	14	72
CAD	5	0	0	75	25
COPD	3	0	33	67	0
CHF	3	0	33	67	0
OHS	2	0	0	50	50

CAD, coronary heart disease; CHF, congestive heart failure; COPD, chronic obstructive pulmonary disease; GERD, gastroesophageal reflux disease; HTN, hypertension; OA/DJD, osteoarthritis/degenerative joint disease; OHS, obesity hypoventilation syndrome.

NOTE. Table from Schauer PR, Ikramuddin S, Gourash W, et al.¹²⁵