



MASSACHUSETTS

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## Medical Policy

# Medical and Surgical Management of Obesity including Anorexiant

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### Policy Number: 379

BCBSA Reference Number: 7.01.47 (For Plan internal use only)

### Related Policies

- Gastric Electrical Stimulation, [#636](#)
- Surgical and Transesophageal Endoscopic Procedures to Treat Gastroesophageal Reflux Disease, [#920](#)

### Policy

#### Commercial Members: Managed Care (HMO and POS), PPO, and Indemnity

#### Surgical Management of Obesity Services Preauthorization Request Form

Providers please complete the form. [Click here for the Surgical Management of Obesity Services preauthorization request form \(#047\)](#).

The following bariatric surgeries may be considered **MEDICALLY NECESSARY** for obesity that has not responded to conservative measures in individuals who meet the "Patient Selection Criteria" described in this policy:

#### **BARIATRIC SURGERY IN ADULTS WITH MORBID OBESITY**

The following bariatric surgical procedures may be considered **MEDICALLY NECESSARY** for the treatment of morbid obesity in adults who have failed weight loss by conservative measures. Bariatric surgery should be performed in appropriately selected individuals, by surgeons who are adequately trained and experienced in the specific techniques used, and in institutions that support a comprehensive bariatric surgery program, including long-term monitoring and follow-up post-surgery.

- Open gastric bypass using a Roux-en-Y anastomosis
- Laparoscopic gastric bypass using a Roux-en-Y anastomosis
- Laparoscopic adjustable gastric banding
- Sleeve gastrectomy
- Open or laparoscopic biliopancreatic bypass (i.e., the Scopinaro procedure) with duodenal switch.

#### Patient Selection Criteria

Adults over the age of 18 or who have documented complete bone growth are eligible for obesity surgery if **ALL** of the following criteria are met:

- The physician has indicated that the patient:
  - Is a well informed and motivated patient with acceptable operative risks, **AND**
  - Has a strong desire for substantial weight loss, **AND**
  - Has failed other non-surgical approaches to long-term weight loss. These approaches (i.e. diet and exercise plans, behavioral changes, etc.) and duration are up to the surgeon's discretion, **AND**
  - Is enrolled in a program which provides pre-op and post-op multidisciplinary evaluation and care including behavioral health, nutrition, and medical management **AND**
- The patient is morbidly obese with a BMI > 40kg/m<sup>2</sup>.  
**OR**
- The patient has a BMI >35kg/m<sup>2</sup> and the physician has indicated that the patient has one or more of the following high risk co-morbid conditions:
  - Sleep apnea
  - Pickwickian syndrome
  - Pseudotumor cerebri
  - Obesity related cardiomyopathy
  - Type II Diabetes
  - At least Stage 1 Hypertension based on JNC-VII (SBP >140 and/or DBP >90) after combination pharmacotherapy
  - Coronary artery disease, or
  - Obesity related pulmonary hypertension.

The following bariatric surgical procedures are considered **INVESTIGATIONAL** for the treatment of morbid obesity in adults who have failed weight loss by conservative measures:

- Vertical-banded gastroplasty
- Gastric bypass using a Billroth II type of anastomosis (mini-gastric bypass)
- Biliopancreatic bypass without duodenal switch
- Long limb gastric bypass (i.e., >150 cm)
- Two-stage bariatric surgery procedures (e.g., sleeve gastrectomy as initial procedure followed by biliopancreatic diversion at a later time)
- Laparoscopic gastric plication
- Single anastomosis duodenoileal bypass with sleeve gastrectomy
- Jejunioleal bypass<sup>1</sup>
- Horizontal gastric partitioning<sup>1</sup>
- Gastric wrapping<sup>1</sup>
- Gastric Electric Stimulation for the treatment of obesity (Gastric pacemaker), and **any** bariatric surgery performed as a cure for type 2 diabetes mellitus.<sup>1</sup>

Revision surgery to address perioperative or late complications of a bariatric procedure is considered **MEDICALLY NECESSARY**. These include but are not limited to, staple line failure, obstruction, stricture, nonabsorption resulting in hypoglycemia or malnutrition, weight loss of 20% or more below ideal body weight, and band slippage that cannot be corrected with manipulation or adjustment.<sup>1</sup>

Repeat surgical procedures for revision or conversion to another surgical procedure is considered **MEDICALLY NECESSARY** for individuals who regained weight after the initial surgery or for inadequate weight loss (unrelated to a surgical complication of a prior procedure).

The following endoscopic procedures are considered **INVESTIGATIONAL** as a primary bariatric procedure or as a revision procedure, (ie, to treat weight gain after bariatric surgery to remedy large gastric stoma or large gastric pouches):

- Insertion of the StomaphyX™ device
- Endoscopic gastroplasty
- Use of an endoscopically placed duodenojejunal sleeve)
- Intra-gastric balloons
- Aspiration therapy device.

### **BARIATRIC SURGERY IN INDIVIDUALS WITH A BMI LESS THAN 35 KG/M<sup>2</sup>**

Bariatric surgery is considered **NOT MEDICALLY NECESSARY** for individuals with a BMI less than 35 kg/m<sup>2</sup>.

### **BARIATRIC SURGERY IN ADOLESCENTS**

Bariatric surgery in adolescents may be considered **MEDICALLY NECESSARY** according to similar weight-based criteria used for adults, but greater consideration should be given to psychosocial and informed consent issues. Individuals must meet the “Patient Selection Criteria” described in this policy. In addition, any devices used for bariatric surgery must be in accordance with the FDA-approved indications.

### **BARIATRIC SURGERY IN PREADOLESCENT CHILDREN**

Bariatric surgery is considered **INVESTIGATIONAL** for the treatment of morbid obesity in preadolescent children.

### **CONCOMITANT HIATAL HERNIA REPAIR WITH BARIATRIC SURGERY**

Repair of a hiatal hernia at the time of bariatric surgery may be considered **MEDICALLY NECESSARY** for individuals who have a preoperatively-diagnosed hiatal hernia with indications for surgical repair.

The Society of American Gastrointestinal and Endoscopic Surgeons have issued evidence-based guidelines for the management of hiatal hernia. Recommendations for indications for repair are as follows:

- Repair of a type I hernia [sliding hiatal hernias, where the gastroesophageal junction migrates above the diaphragm] in the absence of reflux disease is not necessary (moderate quality evidence, strong recommendation).
- All symptomatic paraesophageal hiatal hernias should be repaired (high quality evidence, strong recommendation), particularly those with acute obstructive symptoms or which have undergone volvulus.
- Routine elective repair of completely asymptomatic paraesophageal hernias may not always be indicated. Consideration for surgery should include the patient’s age and comorbidities (moderate quality evidence, weak recommendation).

Repair of a hiatal hernia that is diagnosed at the time of bariatric surgery, or repair of a preoperatively diagnosed hiatal hernia in individuals who do not have indications for surgical repair, is considered **INVESTIGATIONAL**.

The physician-directed visits and testing aspects of multi-faceted dietary programs such as Health Management Resources may be considered **MEDICALLY NECESSARY**.

Non-physician directed and food replacement or supplement components of multi-faceted dietary programs such as Health Management Resources are considered **NOT MEDICALLY NECESSARY**.<sup>1</sup>

The following medical and pharmaceutical treatments for obesity are considered **NOT MEDICALLY NECESSARY**:<sup>1</sup>

- Multi-faceted dietary programs such as Optifast, and Medifast
- Orlistat™ (Xenical®) because it may be purchased over the counter (alli™) without a prescription
- Anorexiant.

## Prior Authorization Information

### Inpatient

- For services described in this policy, precertification/preauthorization **IS REQUIRED** for all products if the procedure is performed **inpatient**.

### Outpatient

- For services described in this policy, see below for products where prior authorization **might be required** if the procedure is performed **outpatient**.

	Outpatient
<b>Commercial Managed Care (HMO and POS)</b>	Prior authorization is <b>required</b> for surgical services. Prior authorization is <b>not required</b> for medical services.
<b>Commercial PPO</b>	Prior authorization is <b>required</b> for surgical services. Prior authorization is <b>not required</b> for medical services.

Providers please complete the Preauthorization Request Form. [Click here for the Surgical Management of Obesity Services preauthorization request form \(#047\)](#)

## CPT Codes / HCPCS Codes / ICD Codes

*Inclusion or exclusion of a code does not constitute or imply member coverage or provider reimbursement. Please refer to the member's contract benefits in effect at the time of service to determine coverage or non-coverage as it applies to an individual member.*

*Providers should report all services using the most up-to-date industry-standard procedure, revenue, and diagnosis codes, including modifiers where applicable.*

*The following codes are included below for informational purposes only; this is not an all-inclusive list.*

**The above medical necessity criteria MUST be met for the following codes to be covered for Commercial Members: Managed Care (HMO and POS), PPO, and Indemnity:**

### CPT Codes

CPT codes:	Code Description
43644	Laparoscopy, surgical, gastric restrictive procedure; with gastric bypass and Roux-en-Y gastroenterostomy (roux limb 150 cm or less)
43770	Laparoscopy, surgical, gastric restrictive procedure; placement of adjustable gastric restrictive device (eg, gastric band and subcutaneous port components)
43775	Laparoscopy, surgical, gastric restrictive procedure; longitudinal gastrectomy (ie, sleeve gastrectomy)
43845	Gastric restrictive procedure with partial gastrectomy, pylorus-preserving duodenoileostomy and ileoileostomy (50 to 100 cm common channel) to limit absorption (biliopancreatic diversion with duodenal switch)
43846	Gastric restrictive procedure, with gastric bypass for morbid obesity; with short limb (150 cm or less) Roux-en-Y gastroenterostomy
43848	Revision, open, of gastric restrictive procedure for morbid obesity, other than adjustable gastric restrictive device (separate procedure)

### ICD-10 Procedure Codes

ICD-10-PCS procedure codes:	Code Description
0DB64Z3	Excision of Stomach, Percutaneous Endoscopic Approach, Vertical
0D160ZA	Bypass Stomach to Jejunum, Open Approach

0D160ZB	Bypass Stomach to Ileum, Open Approach
0D164ZA	Bypass Stomach to Jejunum, Percutaneous Endoscopic Approach
0D164ZB	Bypass Stomach to Ileum, Percutaneous Endoscopic Approach
0D190ZB	Bypass Duodenum to Ileum, Open Approach
0D194ZB	Bypass Duodenum to Ileum, Percutaneous Endoscopic Approach
0DB60Z3	Excision of Stomach, Open Approach, Vertical
0DB60ZZ	Excision of Stomach, Open Approach
0DB80ZZ	Excision of Small Intestine, Open Approach
0DB90ZZ	Excision of Duodenum, Open Approach
0DBB0ZZ	Excision of Ileum, Open Approach
0DM60ZZ	Reattachment of Stomach, Open Approach
0DM64ZZ	Reattachment of Stomach, Percutaneous Endoscopic Approach
0DM80ZZ	Reattachment of Small Intestine, Open Approach
0DM84ZZ	Reattachment of Small Intestine, Percutaneous Endoscopic Approach
0DM90ZZ	Reattachment of Duodenum, Open Approach
0DM94ZZ	Reattachment of Duodenum, Percutaneous Endoscopic Approach
0DMA0ZZ	Reattachment of Jejunum, Open Approach
0DMA4ZZ	Reattachment of Jejunum, Percutaneous Endoscopic Approach
0DMB0ZZ	Reattachment of Ileum, Open Approach
0DMB4ZZ	Reattachment of Ileum, Percutaneous Endoscopic Approach
0DQ60ZZ	Repair Stomach, Open Approach
0DQ64ZZ	Repair Stomach, Percutaneous Endoscopic Approach
0DQ80ZZ	Repair Small Intestine, Open Approach
0DQ84ZZ	Repair Small Intestine, Percutaneous Endoscopic Approach
0DQ90ZZ	Repair Duodenum, Open Approach
0DQ94ZZ	Repair Duodenum, Percutaneous Endoscopic Approach
0DQA0ZZ	Repair Jejunum, Open Approach
0DQA4ZZ	Repair Jejunum, Percutaneous Endoscopic Approach
0DQB0ZZ	Repair Ileum, Open Approach
0DQB4ZZ	Repair Ileum, Percutaneous Endoscopic Approach
0DV60CZ	Restriction of Stomach with Extraluminal Device, Open Approach
0DV64CZ	Restriction of Stomach with Extraluminal Device, Percutaneous Endoscopic Approach

The following ICD Diagnosis Codes are considered medically necessary when submitted with the CPT and/or ICD Procedure Codes above if medical necessity criteria are met:

### ICD-10 Diagnosis Codes

ICD-10-CM Diagnosis codes:	Code Description
E66.01	Morbid (severe) obesity due to excess calories
Z68.35	Body mass index (BMI) 35.0-35.9, adult
Z68.36	Body mass index (BMI) 36.0-36.9, adult
Z68.37	Body mass index (BMI) 37.0-37.9, adult
Z68.38	Body mass index (BMI) 38.0-38.9, adult
Z68.39	Body mass index (BMI) 39.0-39.9, adult
Z68.41	Body mass index (BMI) 40.0-44.9, adult
Z68.42	Body mass index (BMI) 45.0-49.9, adult
Z68.43	Body mass index (BMI) 50-59.9, adult
Z68.44	Body mass index (BMI) 60.0-69.9, adult
Z68.45	Body mass index (BMI) 70 or greater, adult

The following CPT codes are considered investigational for Commercial Members: Managed Care (HMO and POS), PPO, and Indemnity:

### CPT Codes

CPT codes:	Code Description
43645	Laparoscopy, surgical, gastric restrictive procedure; with gastric bypass and small intestine reconstruction to limit absorption
43842	Gastric restrictive procedure, without gastric bypass, for morbid obesity; vertical-banded gastroplasty
43843	Gastric restrictive procedure, without gastric bypass, for morbid obesity; other than vertical-banded gastroplasty
43847	Gastric restrictive procedure, with gastric bypass for morbid obesity; with small intestine reconstruction to limit absorption

## Description

### Bariatric Surgery

Bariatric surgery is performed to treat morbid (clinically severe) obesity. Morbid obesity is defined as a body mass index (BMI) greater than 40 kg/m<sup>2</sup> or a BMI greater than 35 kg/m<sup>2</sup> with associated complications including, but not limited to, diabetes, hypertension, or obstructive sleep apnea. Morbid obesity results in a very high-risk for weight-related complications, such as diabetes, hypertension, obstructive sleep apnea, and various types of cancers (for men: colon, rectal, prostate; for women: breast, uterine, ovarian), and a shortened lifespan. A morbidly obese man at age 20 can expect to live 13 fewer years than his counterpart with a normal BMI, which equates to a 22% reduction in life expectancy.

The first treatment of morbid obesity is dietary and lifestyle changes. Although this strategy may be effective in some individuals, only a few morbidly obese individuals can reduce and control weight through diet and exercise. Most individuals find it difficult to comply with these lifestyle modifications on a long-term basis. When conservative measures fail, some individuals may consider surgical approaches.

Resolution (cure) or improvement of type 2 diabetes after bariatric surgery and observations that glycemic control may improve immediately after surgery before a significant amount of weight is lost have promoted interest in a surgical approach to the treatment of type 2 diabetes. The various surgical procedures have different effects, and gastrointestinal rearrangement seems to confer additional antidiabetic benefits independent of weight loss and caloric restriction. The precise mechanisms are not clear, and multiple mechanisms may be involved. Gastrointestinal peptides, eg, glucagon-like peptide-1, glucose-dependent insulinotropic peptide, and peptide YY, are secreted in response to contact with unabsorbed nutrients and by vagally mediated parasympathetic neural mechanisms. Glucagon-like peptide-1 is secreted by the L cells of the distal ileum in response to ingested nutrients and acts on pancreatic islets to augment glucose-dependent insulin secretion. It also slows gastric emptying, which delays digestion, blunts postprandial glycemia, and acts on the central nervous system to induce satiety and decrease food intake. Other effects may improve insulin sensitivity. Glucose-dependent insulinotropic peptide acts on pancreatic beta cells to increase insulin secretion through the same mechanisms as glucagon-like peptide-1, although it is less potent. Peptide YY is also secreted by the L cells of the distal intestine and increases satiety and delays gastric emptying.

### Types of Bariatric Surgery Procedures

#### Open Gastric Bypass

The original gastric bypass surgeries were based on the observation that postgastrectomy individuals tended to lose weight. The current procedure (CPT code 43846) involves both a restrictive and a malabsorptive component, with the horizontal or vertical partition of the stomach performed in association with a Roux-en-Y procedure (ie, a gastrojejunal). Thus, the flow of food bypasses the duodenum and proximal small bowel. The procedure may also be associated with an unpleasant “dumping syndrome,” in which a large osmotic load delivered directly to the jejunum from the stomach produces abdominal pain and/or vomiting. The dumping syndrome may further reduce intake, particularly in “sweets eaters.”

Surgical complications include leakage and operative margin ulceration at the anastomotic site. Because the normal flow of food is disrupted, there are more metabolic complications than with other gastric restrictive procedures, including iron deficiency anemia, vitamin B12 deficiency, and hypocalcemia, all of which can be corrected by oral supplementation. Another concern is the ability to evaluate the “blind” bypassed portion of the stomach. Gastric bypass may be performed with either an open or laparoscopic technique.

Note: In 2005, CPT code 43846 was revised to indicate that the short limb must be 150 cm or less, compared with the previous 100 cm. This change reflects the common practice in which the alimentary (ie, jejunal limb) of a gastric bypass has been lengthened to 150 cm. This length also serves to distinguish a standard gastric bypass with a very long, or very, very long gastric bypass, as discussed further here.

### **Laparoscopic Gastric Bypass**

CPT code 43644 was introduced in 2005 and described the same procedure as open gastric bypass (CPT code 43846), but performed laparoscopically.

### **Adjustable Gastric Banding**

Adjustable gastric banding (CPT code 43770) involves placing a gastric band around the exterior of the stomach. The band is attached to a reservoir implanted subcutaneously in the rectus sheath. Injecting the reservoir with saline will alter the diameter of the gastric band; therefore, the rate-limiting stoma in the stomach can be progressively narrowed to induce greater weight loss, or expanded if complications develop. Because the stomach is not entered, the surgery and any revisions, if necessary, are relatively simple.

Complications include slippage of the external band or band erosion through the gastric wall. Adjustable gastric banding has been widely used in Europe. Two banding devices are approved by the U.S. Food and Drug Administration (FDA) for marketing in the United States. The first to receive the FDA approval was the LAP-BAND (original applicant, Allergan, BioEnterics, Carpinteria, CA; now Apollo Endosurgery, Austin, TX). The labeled indications for this device are as follows:

"The LAP-BAND® system is indicated for use in weight reduction for severely obese individuals with a BMI of at least 40 or a BMI of at least 35 with 1 or more severe comorbid conditions, or those who are 100 lb or more over their estimated ideal weight according to the 1983 Metropolitan Life Insurance Tables (use the midpoint for medium frame). It is indicated for use only in severely obese adult individuals who have failed more conservative weight-reduction alternatives, such as supervised diet, exercise, and behavior modification programs. Individuals who elect to have this surgery must make the commitment to accept significant changes in their eating habits for the rest of their lives."

In 2011, the FDA-labeled indications for the LAP-BAND were expanded to include individuals with a BMI from 30 to 34 kg/m<sup>2</sup> with at least 1 obesity-related comorbid condition.

The second adjustable gastric banding device approved by the FDA through the premarket approval process is the REALIZE® model (Ethicon Endo-Surgery, Cincinnati, OH). Labeled indications for this device are:

"Th[e REALIZE] device is indicated for weight reduction for morbidly obese individuals and is indicated for individuals with a BMI of at least 40 kg/m<sup>2</sup>, or a BMI of at least 35 kg/m<sup>2</sup> with 1 or more comorbid conditions. The Band is indicated for use only in morbidly obese adult individuals who have failed more conservative weight-reduction alternatives, such as supervised diet, exercise, and behavior modification programs."

### **Sleeve Gastrectomy**

A sleeve gastrectomy (SG; CPT code 43775) is an alternative approach to gastrectomy that can be performed on its own or in combination with malabsorptive procedures (most commonly biliopancreatic

diversion [BPD] with duodenal switch). In this procedure, the greater curvature of the stomach is resected from the angle of His to the distal antrum, resulting in a stomach remnant shaped like a tube or sleeve. The pyloric sphincter is preserved, resulting in a more physiologic transit of food from the stomach to the duodenum and avoiding the dumping syndrome (overly rapid transport of food through the stomach into intestines) seen with distal gastrectomy. This procedure is relatively simple to perform and can be done as an open or laparoscopic procedure. Some surgeons have proposed the SG as the first in a 2-stage procedure for very high-risk individuals. Weight loss following SG may improve a patient's overall medical status and, thus, reduce the risk of a subsequent more extensive malabsorptive procedure (eg, BPD).

### **Biliopancreatic Diversion**

The biliopancreatic diversion (BPD) procedure (also known as the Scopinaro procedure; CPT code 43847), developed and used extensively in Italy, was designed to address drawbacks of the original intestinal bypass procedures that have been abandoned due to unacceptable metabolic complications. Many complications were thought to be related to bacterial overgrowth and toxin production in the blind, bypassed segment. In contrast, BPD consists of a subtotal gastrectomy and diversion of the biliopancreatic juices into the distal ileum by a long Roux-en-Y procedure. The procedure consists of the following components:

- A distal gastrectomy induces temporary early satiety and/or the dumping syndrome in the early postoperative period, both of which limit food intake.
- A 200-cm long "alimentary tract" consists of 200 cm of ileum connecting the stomach to a common distal segment.
- A 300- to 400-cm "biliary tract" connects the duodenum, jejunum, and remaining ileum to the common distal segment.
- A 50- to 100-cm "common tract" is where food from the alimentary tract mixes with biliopancreatic juices from the biliary tract. Food digestion and absorption, particularly of fats and starches, are therefore limited to this small segment of bowel, creating selective malabsorption. The length of the common segment will influence the degree of malabsorption.

Because of the high incidence of cholelithiasis associated with the procedure, individuals typically undergo an associated cholecystectomy.

Many potential metabolic complications are related to BPD, including, most prominently, iron deficiency anemia, protein malnutrition, hypocalcemia, and bone demineralization. Protein malnutrition may require treatment with total parenteral nutrition. Also, several case reports have noted liver failure resulting in death or liver transplant.

### **Biliopancreatic Diversion with Duodenal Switch**

CPT code 43845, which specifically identifies the duodenal switch procedure, was introduced in 2005. The duodenal switch procedure is a variant of the BPD previously described. In this procedure, instead of performing a distal gastrectomy, a SG is performed along the vertical axis of the stomach. This approach preserves the pylorus and initial segment of the duodenum, which is then anastomosed to a segment of the ileum, similar to the BPD, to create the alimentary limb. Preservation of the pyloric sphincter is intended to ameliorate the dumping syndrome and decrease the incidence of ulcers at the duodeno-ileal by providing a more physiologic transfer of stomach contents to the duodenum. The SG also decreases the volume of the stomach and decreases the parietal cell mass. However, the basic principle of the procedure is similar to that of the BPD, ie, producing selective malabsorption by limiting the food digestion and absorption to a short common ileal segment.

### **Vertical-Banded Gastroplasty**

Vertical-banded gastroplasty (VBG; CPT code 43842) was formerly 1 of the most common gastric restrictive procedures performed in the United States but has now been replaced by other restrictive procedures due to high rates of revisions and reoperations. In this procedure, the stomach is segmented along its vertical axis. In order to create a durable reinforced and rate-limiting stoma at the distal end of the pouch, a plug of the stomach is removed, and a propylene collar is placed through this hole and then stapled to itself. Because the normal flow of food is preserved, metabolic complications are uncommon.



Complications include esophageal reflux, dilation, or obstruction of the stoma, with the latter 2 requiring reoperation. Dilation of the stoma is a common reason for weight regain. VBG may be performed using an open or laparoscopic approach.

**Long-Limb Gastric Bypass (ie, >150 cm)**

Variations of gastric bypass procedures have been described, consisting primarily of long-limb Roux-en-Y procedures (CPT code 43847), which vary in the length of the alimentary and common limbs. For example, the stomach may be divided with a long segment of the jejunum (instead of ileum) anastomosed to the proximal gastric stump, creating the alimentary limb. The remaining pancreaticobiliary limb, consisting of stomach remnant, duodenum, and length of proximal jejunum, is then anastomosed to the ileum, creating a common limb of variable length in which the ingested food mixes with the pancreaticobiliary juices. While the long alimentary limb permits absorption of most nutrients, the short common limb primarily limits absorption of fats. The stomach may be bypassed in a variety of ways (eg, resection or stapling along the horizontal or vertical axis). Unlike the traditional gastric bypass, which is a gastric restrictive procedure, these very long-limb Roux-en-Y gastric bypasses combine gastric restriction with some element of malabsorptive procedure, depending on the location of the anastomoses. Note that CPT code for gastric bypass (43846) explicitly describes a short limb (<150 cm) Roux-en-Y gastroenterostomy, and thus would not apply to long-limb gastric bypass.

**Laparoscopic Malabsorptive Procedure**

CPT code 43645 was introduced in 2005, to specifically describe a laparoscopic malabsorptive procedure. However, the code does not specifically describe any specific malabsorptive procedure.

**Weight Loss Outcomes**

There is no uniform standard for reporting results of weight loss or for describing a successful procedure. Common methods of reporting the amount of body weight loss are the percent of ideal body weight achieved or percent of excess body weight (EBW) loss, with the latter most commonly reported. Excess body weight is defined as actual weight minus “ideal weight” and “ideal weight” and is based on 1983 Metropolitan Life Insurance height-weight tables for “medium frame.”

These 2 reporting methods are generally preferred over the absolute amount of weight loss because these methods reflect the ultimate goal of surgery: to reduce weight to a range that minimizes obesity-related morbidity. Obviously, an increasing degree of obesity will require a greater amount of weight loss to achieve these target goals. There are different definitions of successful outcomes, but a successful procedure is often considered one in which at least 50% of EBW is lost, or when the patient returns to within 30% of ideal body weight. The results may also be expressed as the percentage of individuals losing at least 50% of EBW. Table 1 summarizes the variations in reporting weight loss outcomes.

**Table 1. Weight Loss Outcomes**

<b>Outcome Measure</b>	<b>Definition</b>	<b>Clinical Significance</b>
Decrease in weight	Absolute difference in weight pre- and posttreatment	Unclear relation to outcomes, especially in morbidly obese
Decrease in BMI	Absolute difference in BMI pre- and posttreatment	May be clinically significant if change in BMI clearly leads to change in risk category
Percent EBW loss	Amount of weight loss divided by EBW	Has anchor to help frame clinical significance; unclear threshold for clinical significance
Percent patients losing >50% of EBW	No. patients losing >50% EBW divided by total patients	Additional advantage of framing on per patient basis. Threshold for significance (>50%) arbitrary.
Percent ideal body weight	Final weight divided by ideal body weight	Has anchor to help frame clinical significance; unclear threshold for clinical significance

BMI: body mass index; EBW: excess body weight.

**Durability of Weight Loss**

Weight change (ie, gain or loss) at yearly intervals is often reported. Weight loss at 1 year is considered the minimum length of time for evaluating these procedures; weight loss at 3 to 5 years is considered an intermediate time period for evaluating weight loss; and weight loss at 5 to 10 years or more is considered to represent long-term weight loss following bariatric surgery.

### **Short-Term Complications (Operative and Perioperative Complications <30 Days)**

In general, the incidence of operative and perioperative complications is increased in obese individuals, particularly in thromboembolism and wound healing. Other perioperative complications include anastomotic leaks, bleeding, bowel obstruction, and cardiopulmonary complications (eg, pneumonia, myocardial infarction).

### **Reoperation Rate**

Reoperation may be required to “take down” or revise the original procedure. Reoperation may be particularly common in VBG due to pouch dilation.

### **Long-Term Complications (Metabolic Adverse Events, Nutritional Deficiencies)**

Metabolic adverse events are of particular concern in malabsorptive procedures. Other long-term complications include anastomotic ulcers, esophagitis, and procedure-specific complications such as band erosion or migration for gastric banding surgeries.

### **Improved Health Outcomes in Terms of Weight-Related Comorbidities**

Aside from psychosocial concerns, which may be considerable, one motivation for bariatric surgery is to decrease the incidence of complications of obesity, such as diabetes, cardiovascular risk factors (ie, increased cholesterol, hypertension), obstructive sleep apnea, or arthritis. Unfortunately, these final health outcomes are not consistently reported.

## **Summary**

Bariatric surgery is a treatment for morbid obesity in individuals who fail to lose weight with conservative measures. There are numerous gastric and intestinal surgical techniques available. While these techniques have heterogeneous mechanisms of action, the result is a smaller gastric pouch that leads to restricted eating. However, these surgeries may lead to malabsorption of nutrients or eventually to metabolic changes.

### **Summary of Evidence**

#### **Adults with Morbid Obesity**

For individuals who are adults with morbid obesity who receive gastric bypass, the evidence includes randomized controlled trials (RCTs), observational studies, and systematic reviews. Relevant outcomes are overall survival (OS), change in disease status, functional outcomes, health status measures, quality of life, and treatment-related mortality and morbidity. TEC Assessments and other systematic reviews of RCTs and observational studies found that gastric bypass improves health outcomes, including weight loss and remission of type 2 diabetes (T2D). A TEC Assessment found similar weight loss with open and laparoscopic gastric bypass. The evidence is sufficient to determine that the technology results in an improvement in the net health outcome.

For individuals who are adults with morbid obesity who receive laparoscopic adjustable gastric banding (LAGB), the evidence includes RCTs, observational studies, and systematic reviews. Relevant outcomes are OS, change in disease status, functional outcomes, health status measures, quality of life, and treatment-related mortality and morbidity. Systematic reviews of RCTs and observational studies have found that LAGB is a reasonable alternative to gastric bypass. There is less weight loss with LAGB than with gastric bypass, but LAGB is less invasive and is associated with fewer serious adverse events. The evidence is sufficient to determine that the technology results in an improvement in the net health outcome.

For individuals who are adults with morbid obesity who receive sleeve gastrectomy (SG), the evidence includes RCTs, observational studies (evaluating SG alone and comparing SG with gastric bypass), as

well as systematic reviews. Relevant outcomes are OS, change in disease status, functional outcomes, health status measures, quality of life, and treatment-related mortality and morbidity. Systematic reviews of RCTs and observational studies have found that SG results in substantial weight loss and that this weight loss is durable for at least 5 years. A meta-analysis found that short-term weight loss was similar after SG compared with gastric bypass. Long-term weight loss was greater after gastric bypass, but SG is associated with fewer adverse events. The evidence is sufficient to determine that the technology results in an improvement in the net health outcome.

For individuals who are adults with morbid obesity who receive biliopancreatic diversion (BPD) with duodenal switch (DS), the evidence includes nonrandomized comparative studies, observational studies, and a systematic review. Relevant outcomes are OS, change in disease status, functional outcomes, health status measures, quality of life, and treatment-related mortality and morbidity. Nonrandomized comparative studies have found significantly higher weight loss after BPD with DS compared with gastric bypass at 1 year. A large case series found sustained weight loss after 7 years. The evidence is sufficient to determine that the technology results in an improvement in the net health outcome.

For individuals who are adults with morbid obesity who receive BPD without DS, the evidence includes observational studies and systematic reviews. Relevant outcomes are OS, change in disease status, functional outcomes, health status measures, quality of life, and treatment-related mortality and morbidity. A TEC Assessment reviewed the available observational studies and concluded that weight loss was similar after BPD without a DS or gastric bypass. However, concerns have been raised about complications associated with BPD without DS, especially long-term nutritional and vitamin deficiencies. The evidence is insufficient to determine that the technology results in an improvement in the net health outcome.

For individuals who are adults with morbid obesity who receive vertical-banded gastroplasty (VBG), the evidence includes observational studies and systematic reviews. Relevant outcomes are OS, change in disease status, functional outcomes, health status measures, quality of life, and treatment-related mortality and morbidity. A TEC Assessment identified 8 nonrandomized comparative studies evaluating VBG, and these studies found that weight loss was significantly greater with open gastric bypass. Moreover, VBG has relatively high rates of complications, revisions, and reoperations. The evidence is insufficient to determine that the technology results in an improvement in the net health outcome.

For individuals who are adults with morbid obesity who receive 2-stage bariatric surgery procedures, the evidence includes a small RCT, observational studies, and case series. Relevant outcomes are OS, change in disease status, functional outcomes, health status measures, quality of life, and treatment-related mortality and morbidity. There is a lack of evidence that 2-stage bariatric procedures improve outcomes compared with 1-stage procedures. The small RCT compared intragastric balloon (IGB) plus gastric bypass with the standard of care plus gastric bypass and did not detect a difference in weight loss at 6 months postsurgery. Case series have shown relatively high complication rates in 2-stage procedures, and individuals are at risk of complications in both stages. The evidence is insufficient to determine that the technology results in an improvement in the net health outcome.

For individuals who are adults with morbid obesity who receive laparoscopic gastric plication, the evidence includes 2 RCTs, observational studies, and systematic reviews. Relevant outcomes are OS, change in disease status, functional outcomes, health status measures, quality of life, and treatment-related mortality and morbidity. A 2014 systematic review only identified a small nonrandomized comparative study comparing laparoscopic gastric plication with other bariatric surgery procedures. Since the systematic review, 2 RCTs have been published, 1 comparing laparoscopic gastric plication with a sham procedure and another comparing laparoscopic gastric plication with SG. Laparoscopic gastric plication was more effective than sham at 1-year follow-up and equally effective as SG at 2-year follow-up. Additional comparative studies and RCTs with longer follow-up are needed to permit conclusions about the safety and efficacy of laparoscopic gastric plication. The evidence is insufficient to determine that the technology results in an improvement in the net health outcome.

For individuals who are adults with morbid obesity who receive single anastomosis duodeno-ileal bypass with SG (SADI-S), the evidence includes a systematic review of observational studies and case series. Relevant outcomes are OS, change in disease status, functional outcomes, health status measures, quality of life, and treatment-related mortality and morbidity. A systematic review of 12 observational studies concluded that SADI-S was associated with promising weight loss and comorbidity resolution. A comparative chart review found that individuals without diabetes experienced significantly better weight loss and lipid profiles with SADI-S than with RYGB and individuals who had diabetes experienced significantly higher rates of remission with SADI-S than with RYGB. Comparative studies and especially RCTs are needed to permit conclusions about the safety and efficacy of SADI-S. The evidence is insufficient to determine that the technology results in an improvement in the net health outcome.

For individuals who are adults with morbid obesity who receive duodenojejunal sleeve, the evidence includes RCTs and systematic reviews. Relevant outcomes are OS, change in disease status, functional outcomes, health status measures, quality of life, and treatment-related mortality and morbidity. A systematic review of duodenojejunal sleeves included 5 RCTs and found significantly greater short-term weight loss (12 to 24 weeks) with the sleeves compared with medical therapy. There was no significant difference in symptoms associated with diabetes. All RCTs were small and judged by systematic reviewers to be at high-risk of bias. High-quality comparative studies are needed to permit conclusions on the safety and efficacy of the procedure. The evidence is insufficient to determine that the technology results in an improvement in the net health outcome.

For individuals who are adults with morbid obesity who receive IGB devices, the evidence includes RCTs, systematic reviews, and case series. Relevant outcomes are OS, change in disease status, functional outcomes, health status measures, quality of life, and treatment-related mortality and morbidity. RCTs assessing the 2 IGB devices approved by the U.S. Food and Drug Administration have found significantly greater weight loss with IGB than with sham treatment or lifestyle therapy alone after 6 months (maximum length of device use). Some adverse events were reported, mainly related to accommodation of the balloon in the stomach; in a minority of cases, these adverse events were severe. One RCT followed individuals for an additional 6 months after IGB removal and found sustained weight loss. There are limited data on the durability of weight loss in the long-term. Comparative data are lacking. A large case series found that individuals gradually regained weight over time. Moreover, it is unclear how 6 months of IGB use would fit into a long-term weight loss and maintenance intervention. The evidence is insufficient to determine that the technology results in an improvement in the net health outcome.

For individuals who are adults with morbid obesity who receive an aspiration therapy device, the evidence includes an RCT and case series. Relevant outcomes are OS, change in disease status, functional outcomes, health status measures, quality of life, and treatment-related mortality and morbidity. The RCT found significantly greater weight loss with aspiration therapy than lifestyle therapy at 1 year. Forty of 58 individuals (69%) achieved at least 10% total weight loss at 4 years or at time of study withdrawal; however, only 15/111 initial aspiration therapy individuals completed the study through 4 years. In addition to a high degree of missing data, the Pivotal Aspiration Therapy with Adjusted Lifestyle (PATHWAY) study noted a potentially large number of adverse events related to A-tube malfunction, an element of the therapy which is expected to require replacement within approximately 3.5 years post gastrostomy in 50% of cases. The impact of this on health outcomes compared to existing surgical approaches is unknown. One small case series reported on 15 individuals at 2 years. The total amount of data on aspiration therapy remains limited and additional studies are needed before conclusions can be drawn about the effects of treatment on weight loss, metabolism, safety, nutrition, and long-term durability of treatment. The evidence is insufficient to determine that the technology results in an improvement in the net health outcome.

### **Revision Bariatric Surgery**

For individuals who are adults with morbid obesity and failed bariatric surgery who receive revision bariatric surgery, the evidence includes case series and registry data. Relevant outcomes are OS, change in disease status, functional outcomes, health status measures, quality of life, and treatment-related mortality and morbidity. Case series have shown that individuals receiving revision bariatric

surgery experienced satisfactory weight loss. Data from a multinational bariatric surgery database has found that corrective procedures following primary bariatric surgery are relatively uncommon but generally safe and efficacious. The evidence is sufficient to determine that the technology results in an improvement in the net health outcome.

### **Adults with Type 2 Diabetes**

For individuals who are diabetic and not morbidly obese who receive gastric bypass, SG, BPD, or LAGB, the evidence includes RCTs, nonrandomized comparative studies, and case series. Relevant outcomes are OS, change in disease status, functional outcomes, health status measures, quality of life, and treatment-related mortality and morbidity. Systematic reviews of RCTs and observational studies have found that certain types of bariatric surgery are more efficacious than medical therapy as a treatment for type 2 diabetes in obese individuals, including those with a body mass index (BMI) between 30 and 34.9 kg/m<sup>2</sup>. The greatest amount of evidence is on gastric bypass. Systematic reviews have found significantly greater remission rates of diabetes, decrease in hemoglobin A1c levels, and decrease in BMI with bariatric surgery than with nonsurgical treatment. The efficacy of surgery is balanced against the short-term risks of the surgical procedure. Most RCTs in this population have 1 to 3 years of follow-up; with a few having 5-year follow-up data. There are clinical concerns about durability and long-term outcomes at 5 to 10 years as well as potential variation in observed outcomes in community practice versus clinical trials. The evidence is sufficient to determine that the technology results in an improvement in the net health outcome.

### **Nondiabetic and Nonobese Adults**

For individuals who are not diabetic and not morbidly obese who receive any bariatric surgery procedure, the evidence includes RCTs, nonrandomized comparative studies, and case series. Relevant outcomes are OS, change in disease status, functional outcomes, health status measures, quality of life, and treatment-related mortality and morbidity. There is limited evidence for bariatric surgery in individuals who are not diabetic or morbidly obese. A few small RCTs and case series have reported a loss of weight and improvements in comorbidities for this population. However, the evidence does not permit conclusions on the long-term risk-benefit ratio of bariatric surgery in this population. The evidence is insufficient to determine that the technology results in an improvement in the net health outcome.

### **Adolescent Children with Morbid Obesity Gastric Bypass, Laparoscopic Adjustable Gastric Banding, or Sleeve Gastrectomy**

For individuals who are adolescent children with morbid obesity who receive gastric bypass, or LAGB, or SG, the evidence includes RCTs, observational studies, and systematic reviews. Relevant outcomes are OS, change in disease status, functional outcomes, health status measures, quality of life, and treatment-related mortality and morbidity. Systematic reviews of studies on bariatric surgery in adolescents, who mainly received gastric bypass or LAGB or SG, found significant weight loss and reductions in comorbidity outcomes with bariatric surgery. For bariatric surgery in the adolescent population, although data are limited on some procedures, studies have generally reported that weight loss and reduction in risk factors for adolescents are similar to that for adults. Most experts and clinical practice guidelines have recommended that bariatric surgery in adolescents be reserved for individuals with severe comorbidities, or for individuals with a BMI greater than 50 kg/m<sup>2</sup>. Also, greater consideration should be placed on the patient developmental stage, on the psychosocial aspects of obesity and surgery, and on ensuring that the patient can provide fully informed consent. The evidence is sufficient to determine that the technology results in an improvement in the net health outcome.

### **Bariatric Surgery Other Than Gastric Bypass, Laparoscopic Adjustable Gastric Banding, or Sleeve Gastrectomy**

For individuals who are adolescent children with morbid obesity who receive bariatric surgery other than gastric bypass, or LAGB, or SG, the evidence includes systematic reviews and a cohort study. Relevant outcomes are OS, change in disease status, functional outcomes, health status measures, quality of life, and treatment-related mortality and morbidity. Studies using bariatric surgery other than gastric bypass, LAGB, or SG, have small sample sizes. Results from a meta-analysis including individuals using other procedures have shown significant improvements in BMI reduction, fasting blood insulin, and total

cholesterol, although the estimates have wide confidence intervals, limiting interpretation. The evidence is insufficient to determine that the technology results in an improvement in the net health outcome.

### **Preadolescent Children with Morbid Obesity**

For individuals who are preadolescent children with morbid obesity who receive bariatric surgery, the evidence includes no studies focused on this population. Relevant outcomes are OS, change in disease status, functional outcomes, health status measures, quality of life, and treatment-related mortality and morbidity. Several studies of bariatric surgery in adolescents have also included children younger than 12 years old, but findings were not reported separately for preadolescent children. Moreover, clinical practice guidelines have recommended against bariatric surgery for preadolescent children. The evidence is insufficient to determine that the technology results in an improvement in the net health outcome.

### **Hiatal Hernia Repair with Bariatric Surgery**

For individuals with morbid obesity and a preoperative diagnosis of a hiatal hernia who receive hiatal hernia repair with bariatric surgery, the evidence includes cohort studies and case series. Relevant outcomes are OS, change in disease status, functional outcomes, health status measures, quality of life, and treatment-related mortality and morbidity. Results from the cohort studies and case series have shown that, when a preoperative diagnosis of a hiatal hernia has been present, repairing the hiatal hernia during bariatric surgery resulted in fewer complications. However, the results are limited to individuals with a preoperative diagnosis. There was no evidence on the use of hiatal hernia repair when the hiatal hernia diagnosis is incidental. The evidence is sufficient to determine that the technology results in an improvement in the net health outcome.

## **Policy History**

<b>Date</b>	<b>Action</b>
6/2022	Policy clarified. Policy statements on revision surgery to address perioperative or late complications of a bariatric procedure added.
6/2022	Prior authorization information clarified for PPO plans. Effective 6/1/2022.
4/2021	Annual policy review. Policy statement for adolescent bariatric surgery clarified due to updated weight-based criteria used for adults issued by the American Academy of Pediatrics.
1/2021	Policy clarified to include the following criteria: Has failed other non-surgical approaches to long-term weight loss. These approaches (i.e., diet and exercise plans, behavioral changes, etc.) and duration are up to the surgeon's discretion.
1/2021	Medicare information removed. See MP #132 Medicare Advantage Management for local coverage determination and national coverage determination reference.
4/2020	Annual policy review. Description, summary and references updated. Policy statements unchanged.
4/2019	Annual policy review. Description, summary and references updated. Policy statements unchanged.
3/2018	Annual policy review. New references added.
9/2017	Annual policy review. Investigational statement on endoscopic procedures rewritten for clarity; aspiration therapy device added to the investigational statement. Investigational statement on bariatric surgery in preadolescent children added. Effective 9/1/2017.
7/2016	Annual policy review. Single anastomosis duodenoileal bypass with sleeve gastrectomy added to investigational statement. Effective 7/1/2016.
3/2016	Policy statement removed: Medical management of obesity may be medically necessary including laboratory services and other diagnostic tests prescribed by the physician specialist, and nutritional counseling in accordance with the member's subscriber certificate. Clarified coding information. Effective 3/1/2016.
1/2016	Prior authorization information clarified. 1/1/2016.
10/2015	Clarified coding information.

6/2015	Medically necessary statements on revision bariatric surgery retired. Coding information clarified. Effective 6/1/2015.
3/2015	Annual policy review. New medically necessary and investigational indications described. Statement on bariatric surgery in individuals with BMI <35 changed from investigational to not medically necessary. Effective 3/1/2015.
10/2014	Language on Health Management Resources clarified.
9/2014	Clarified coding information. Surgical Management of Obesity Services Preauthorization Request Form transferred to #047.
6/2014	Updated Coding section with ICD10 procedure and diagnosis codes, effective 10/2015.
3/2014	Annual policy review. Language added to policy statement on revision surgery to include complications of laparoscopic adjustable gastric banding. Effective 3/1/2014.
4/2013	Annual policy review. Changes to policy statement. Effective 4/1/2013.
11/2011-4/2012	Medical policy ICD 10 remediation: Formatting, editing and coding updates. No changes to policy statements.
1/2012	Annual policy review. Changes to policy statements.
5/2011	Reviewed - Medical Policy Group - Pediatrics and Endocrinology. No changes to policy statements.
11/2010	Reviewed - Medical Policy Group - Gastroenterology, Nutrition and Organ Transplantation. No changes to policy statements.
11/2010	Annual policy review. Changes to policy statements.
2/2010	Reviewed - Medical Policy Group - Psychiatry and Ophthalmology. No changes to policy statements.
11/2009	Reviewed - Medical Policy Group - Gastroenterology, Nutrition and Organ Transplantation. No changes to policy statements.
11/2009	Annual policy review. Changes to policy statements.
2/2009	Reviewed - Medical Policy Group - Psychiatry and Ophthalmology. No changes to policy statements.
11/2008	Reviewed - Medical Policy Group - Gastroenterology, Nutrition and Organ Transplantation. No changes to policy statements.
9/2008	Annual policy review. Changes to policy statements.
4/2008	Annual policy review. Changes to policy statements.
2/2008	Reviewed - Medical Policy Group - Psychiatry and Ophthalmology. No changes to policy statements.
5/2007	Annual policy review. BCBSA National medical policy review. Changes to policy statements.
2/2007	Reviewed - Medical Policy Group - Psychiatry and Ophthalmology. No changes to policy statements.
5/1996	New policy describing covered and non-covered indications. Effective 5/1996.

## Information Pertaining to All Blue Cross Blue Shield Medical Policies

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## References

1. Armstrong SC, Bolling CF, Michalsky MP, et al. Pediatric Metabolic and Bariatric Surgery: Evidence, Barriers, and Best Practices. Pediatrics. Dec 2019; 144(6). PMID 31656225
2. Balsiger BM, Poggio JL, Mai J, et al. Ten and more years after vertical banded gastroplasty as primary operation for morbid obesity. J Gastrointest Surg. Nov-Dec 2000;4(6):598-605. PMID 11307094

3. Miller K, Pump A, Hell E. Vertical banded gastroplasty versus adjustable gastric banding: prospective long-term follow-up study. *Surg Obes Relat Dis.* Jan-Feb 2007;3(1):84-90. PMID 17116427
4. American Society for Metabolic and Bariatric Surgery (ASMBS). ASMBS Endorsed Procedures and FDA Approved Devices. March 2019; <https://asmbs.org/resources/endorsed-procedures-and-devices>. Accessed December 21, 2020.
5. Styne DM, Arslanian SA, Connor EL, et al. Pediatric Obesity-Assessment, Treatment, and Prevention: An Endocrine Society Clinical Practice Guideline. *J Clin Endocrinol Metab.* Mar 01 2017; 102(3): 709-757. PMID 28359099
6. Fitch A, Fox C, Bauerly K, et al. Health Care Guideline: Prevention and Management of Obesity for Children and Adolescents. Institute for Clinical Systems Improvement. 2013; [https://www.healthpartners.com/ucm/groups/public/@hp/@public/documents/documents/cntrb\\_037112.pdf](https://www.healthpartners.com/ucm/groups/public/@hp/@public/documents/documents/cntrb_037112.pdf). Accessed December 10, 2020.
7. Aikenhead A, Lobstein T, Knai C. Review of current guidelines on adolescent bariatric surgery. *Clin Obes*, 2011 Feb 1;1(1). PMID 25586970
8. Pratt JSA, Browne A, Browne NT, et al. ASMBS pediatric metabolic and bariatric surgery guidelines, 2018. *Surg Obes Relat Dis.* Jul 2018; 14(7): 882-901. PMID 30077361
9. Menzo EL, Hinojosa M, Carbonell A, et al. American Society for Metabolic and Bariatric Surgery and American Hernia Society consensus guideline on bariatric surgery and hernia surgery. *Surg Obes Relat Dis.* Sep 2018; 14(9): 1221-1232. PMID 30154033
10. Kohn GP, Price RR, DeMeester SR, et al. Guidelines for the management of hiatal hernia. *Surg Endosc.* Dec 2013;27(12):4409-4428. PMID 24018762
11. O'Brien PE, Sawyer SM, Laurie C, et al. Laparoscopic adjustable gastric banding in severely obese adolescents: a randomized trial. *JAMA.* Feb 10 2010;303(6):519-526. PMID 20145228
12. Sjostrom L, Lindroos AK, Peltonen M, et al. Lifestyle, diabetes, and cardiovascular risk factors 10 years after bariatric surgery. *N Engl J Med.* Dec 23 2004;351(26):2683-2693. PMID 15616203
13. Scopinaro N, Papadia F, Marinari G, et al. Long-term control of type 2 diabetes mellitus and the other major components of the metabolic syndrome after biliopancreatic diversion in patients with BMI < 35 kg/m<sup>2</sup>. *Obes Surg.* Feb 2007;17(2):185-192. PMID 17476869
14. Sjostrom CD, Lissner L, Wedel H, et al. Reduction in incidence of diabetes, hypertension and lipid disturbances after intentional weight loss induced by bariatric surgery: the SOS Intervention Study. *Obes Res.* Sep 1999;7(5):477-484. PMID 10509605
15. Sjostrom L, Narbro K, Sjostrom CD, et al. Effects of bariatric surgery on mortality in Swedish obese subjects. *N Engl J Med.* Aug 23 2007;357(8):741-752. PMID 17715408
16. Courcoulas AP, Christian NJ, Belle SH, et al. Weight change and health outcomes at 3 years after bariatric surgery among individuals with severe obesity. *JAMA.* Dec 11 2013;310(22):2416-2425. PMID 24189773
17. Arterburn D, Wellman R, Emiliano A, et al. Comparative Effectiveness and Safety of Bariatric Procedures for Weight Loss: A PCORnet Cohort Study. *Ann Intern Med.* Dec 04 2018; 169(11): 741-750. PMID 30383139
18. Buchwald H, Avidor Y, Braunwald E, et al. Bariatric surgery: a systematic review and meta-analysis. *JAMA.* Oct 13 2004;292(14):1724-1737. PMID 15479938
19. Maggard MA, Shugarman LR, Suttorp M, et al. Meta-analysis: surgical treatment of obesity. *Ann Intern Med.* Apr 5 2005;142(7):547-559. PMID 15809466
20. Park CH, Nam SJ, Choi HS, et al. Comparative Efficacy of Bariatric Surgery in the Treatment of Morbid Obesity and Diabetes Mellitus: a Systematic Review and Network Meta-Analysis. *Obes Surg.* Jul 2019; 29(7): 2180-2190. PMID 31037599
21. Kang JH, Le QA. Effectiveness of bariatric surgical procedures: A systematic review and network meta-analysis of randomized controlled trials. *Medicine (Baltimore).* Nov 2017; 96(46): e8632. PMID 29145284
22. Colquitt JL, Pickett K, Loveman E, et al. Surgery for weight loss in adults. *Cochrane Database Syst Rev.* 2014;8:CD003641. PMID 25105982
23. Gloy VL, Briel M, Bhatt DL, et al. Bariatric surgery versus non-surgical treatment for obesity: a systematic review and meta-analysis of randomised controlled trials. *BMJ.* Oct 22 2013;347:f5934. PMID 24149519



24. Chang SH, Stoll CR, Song J, et al. The effectiveness and risks of bariatric surgery: an updated systematic review and meta-analysis, 2003-2012. *JAMA Surg.* Mar 2014;149(3):275-287. PMID 24352617
25. Wilhelm SM, Young J, Kale-Pradhan PB. Effect of bariatric surgery on hypertension: a meta-analysis. *Ann Pharmacother.* Jun 2014;48(6):674-682. PMID 24662112
26. Ricci C, Gaeta M, Rausa E, et al. Early impact of bariatric surgery on type II diabetes, hypertension, and hyperlipidemia: a systematic review, meta-analysis and meta-regression on 6,587 patients. *Obes Surg.* Apr 2014;24(4):522-528. PMID 24214202
27. Cuspidi C, Rescaldani M, Tadic M, et al. Effects of bariatric surgery on cardiac structure and function: a systematic review and meta-analysis. *Am J Hypertens.* Feb 2014;27(2):146-156. PMID 24321879
28. Kwok CS, Pradhan A, Khan MA, et al. Bariatric surgery and its impact on cardiovascular disease and mortality: a systematic review and meta-analysis. *Int J Cardiol.* Apr 15 2014;173(1):20-28. PMID 24636546
29. Afshar S, Kelly SB, Seymour K, et al. The effects of bariatric surgery on colorectal cancer risk: systematic review and meta-analysis. *Obes Surg.* Oct 2014;24(10):1793-1799. PMID 25015708
30. Andersen JR, Aasprang A, Karlsen TI, et al. Health-related quality of life after bariatric surgery: a systematic review of prospective long-term studies. *Surg Obes Relat Dis.* Mar-Apr 2015; 11(2): 466-73. PMID 25820082
31. Arterburn DE, Olsen MK, Smith VA, et al. Association between bariatric surgery and long-term survival. *JAMA.* Jan 6 2015;313(1):62-70. PMID 25562267
32. Bower G, Toma T, Harling L, et al. Bariatric Surgery and Non-Alcoholic Fatty Liver Disease: a Systematic Review of Liver Biochemistry and Histology. *Obes Surg.* Dec 2015; 25(12): 2280-9. PMID 25917981
33. Cheung D, Switzer NJ, Ehmann D, et al. The impact of bariatric surgery on diabetic retinopathy: a systematic review and meta-analysis. *Obes Surg.* Sep 2015;25(9):1604-1609. PMID 25515499
34. Driscoll S, Gregory DM, Fardy JM, et al. Long-term health-related quality of life in bariatric surgery patients: A systematic review and meta-analysis. *Obesity (Silver Spring).* Jan 2016; 24(1): 60-70. PMID 26638116
35. Groen VA, van de Graaf VA, Scholtes VA, et al. Effects of bariatric surgery for knee complaints in (morbidly) obese adult patients: a systematic review. *Obes Rev.* Feb 2015;16(2):161-170. PMID 25487972
36. Hachem A, Brennan L. Quality of Life Outcomes of Bariatric Surgery: A Systematic Review. *Obes Surg.* Feb 2016; 26(2): 395-409. PMID 26494369
37. Lindekilde N, Gladstone BP, Lubeck M, et al. The impact of bariatric surgery on quality of life: a systematic review and meta-analysis. *Obes Rev.* Aug 2015; 16(8): 639-51. PMID 26094664
38. Lopes EC, Heineck I, Athaydes G, et al. Is Bariatric Surgery Effective in Reducing Comorbidities and Drug Costs? A Systematic Review and Meta-Analysis. *Obes Surg.* Sep 2015; 25(9): 1741-9. PMID 26112137
39. Ricci C, Gaeta M, Rausa E, et al. Long-term effects of bariatric surgery on type II diabetes, hypertension and hyperlipidemia: a meta-analysis and meta-regression study with 5-year follow-up. *Obes Surg.* Mar 2015;25(3):397-405. PMID 25240392
40. Yang XW, Li PZ, Zhu LY, et al. Effects of bariatric surgery on incidence of obesity-related cancers: a meta-analysis. *Med Sci Monit.* May 11 2015; 21: 1350-7. PMID 25961664
41. Madadi F, Jawad R, Mousati I, et al. Remission of Type 2 Diabetes and Sleeve Gastrectomy in Morbid Obesity: a Comparative Systematic Review and Meta-analysis. *Obes Surg.* Dec 2019; 29(12): 4066-4076. PMID 31655953
42. Yan G, Wang J, Zhang J, et al. Long-term outcomes of macrovascular diseases and metabolic indicators of bariatric surgery for severe obesity type 2 diabetes patients with a meta-analysis. *PLoS One.* 2019; 14(12): e0224828. PMID 31794559
43. Wiggins T, Guidozi N, Welbourn R, et al. Association of bariatric surgery with all-cause mortality and incidence of obesity-related disease at a population level: A systematic review and meta-analysis. *PLoS Med.* Jul 2020; 17(7): e1003206. PMID 32722673
44. Puzziferri N, Roshek TB, 3rd, Mayo HG, et al. Long-term follow-up after bariatric surgery: a systematic review. *JAMA.* Sep 3 2014;312(9):934-942. PMID 25182102

45. Blue Cross Blue Shield Association Technology Evaluation Center (TEC). Laparoscopic gastric bypass surgery for morbid obesity. TEC Assessment. 2005;Vol:Tab 15.
46. Yan Y, Sha Y, Yao G, et al. Roux-en-Y Gastric Bypass Versus Medical Treatment for Type 2 Diabetes Mellitus in Obese Patients: A Systematic Review and Meta-Analysis of Randomized Controlled Trials. *Medicine (Baltimore)*. Apr 2016; 95(17): e3462. PMID 27124041
47. Wadden TA, Chao AM, Bahnson JL, et al. End-of-Trial Health Outcomes in Look AHEAD Participants who Elected to have Bariatric Surgery. *Obesity (Silver Spring)*. Apr 2019; 27(4): 581-590. PMID 30900413
48. Blue Cross Blue Shield Association Technology Evaluation Center (TEC). Laparoscopic adjustable gastric banding for morbid obesity. TEC Assessment. 2006;Vol 21:Tab 13.
49. Ibrahim AM, Thumma JR, Dimick JB. Reoperation and Medicare Expenditures After Laparoscopic Gastric Band Surgery. *JAMA Surg*. Sep 01 2017; 152(9): 835-842. PMID 28514487
50. Chakravarty PD, McLaughlin E, Whittaker D, et al. Comparison of laparoscopic adjustable gastric banding (LAGB) with other bariatric procedures; a systematic review of the randomised controlled trials. *Surgeon*. Jun 2012;10(3):172-182. PMID 22405735
51. Dixon JB, O'Brien PE, Playfair J, et al. Adjustable gastric banding and conventional therapy for type 2 diabetes: a randomized controlled trial. *JAMA*. Jan 23 2008;299(3):316-323. PMID 18212316
52. Gu L, Huang X, Li S, et al. A meta-analysis of the medium- and long-term effects of laparoscopic sleeve gastrectomy and laparoscopic Roux-en-Y gastric bypass. *BMC Surg*. Feb 12 2020; 20(1): 30. PMID 32050953
53. Han Y, Jia Y, Wang H, et al. Comparative analysis of weight loss and resolution of comorbidities between laparoscopic sleeve gastrectomy and Roux-en-Y gastric bypass: A systematic review and meta-analysis based on 18 studies. *Int J Surg*. Apr 2020; 76: 101-110. PMID 32151750
54. Sharples AJ, Mahawar K. Systematic Review and Meta-Analysis of Randomised Controlled Trials Comparing Long-Term Outcomes of Roux-En-Y Gastric Bypass and Sleeve Gastrectomy. *Obes Surg*. Feb 2020; 30(2): 664-672. PMID 31724116
55. Shenoy SS, Gilliam A, Mehanna A, et al. Laparoscopic Sleeve Gastrectomy Versus Laparoscopic Roux-en-Y Gastric Bypass in Elderly Bariatric Patients: Safety and Efficacy-a Systematic Review and Meta-analysis. *Obes Surg*. Nov 2020; 30(11): 4467-4473. PMID 32594469
56. Borgeraas H, Hofso D, Hertel JK, et al. Comparison of the effect of Roux-en-Y gastric bypass and sleeve gastrectomy on remission of type 2 diabetes: A systematic review and meta-analysis of randomized controlled trials. *Obes Rev*. Jun 2020; 21(6): e13011. PMID 32162437
57. Zhao H, Jiao L. Comparative analysis for the effect of Roux-en-Y gastric bypass vs sleeve gastrectomy in patients with morbid obesity: Evidence from 11 randomized clinical trials (meta-analysis). *Int J Surg*. Dec 2019; 72: 216-223. PMID 31756544
58. Xu C, Yan T, Liu H, et al. Comparative Safety and Effectiveness of Roux-en-Y Gastric Bypass and Sleeve Gastrectomy in Obese Elder Patients: a Systematic Review and Meta-analysis. *Obes Surg*. Sep 2020; 30(9): 3408-3416. PMID 32277330
59. Osland E, Yunus RM, Khan S, et al. Weight Loss Outcomes in Laparoscopic Vertical Sleeve Gastrectomy (LVSG) Versus Laparoscopic Roux-en-Y Gastric Bypass (LRYGB) Procedures: A Meta-Analysis and Systematic Review of Randomized Controlled Trials. *Surg Laparosc Endosc Percutan Tech*. Feb 2017; 27(1): 8-18. PMID 28145963
60. Osland EJ, Yunus RM, Khan S, et al. Five-Year Weight Loss Outcomes in Laparoscopic Vertical Sleeve Gastrectomy (LVSG) Versus Laparoscopic Roux-en-Y Gastric Bypass (LRYGB) Procedures: A Systematic Review and Meta-Analysis of Randomized Controlled Trials. *Surg Laparosc Endosc Percutan Tech*. Dec 2020; 30(6): 542-553. PMID 32658120
61. Juodeikis Z, Brimas G. Long-term results after sleeve gastrectomy: A systematic review. *Surg Obes Relat Dis*. Apr 2017; 13(4): 693-699. PMID 27876332
62. Zhang Y, Wang J, Sun X, et al. Laparoscopic sleeve gastrectomy versus laparoscopic Roux-en-Y gastric bypass for morbid obesity and related comorbidities: a meta-analysis of 21 studies. *Obes Surg*. Jan 2015;25(1):19-26. PMID 25092167
63. Trastulli S, Desiderio J, Guarino S, et al. Laparoscopic sleeve gastrectomy compared with other bariatric surgical procedures: a systematic review of randomized trials. *Surg Obes Relat Dis*. Sep-Oct 2013;9(5):816-829. PMID 23993246

64. Brethauer SA, Hammel JP, Schauer PR. Systematic review of sleeve gastrectomy as staging and primary bariatric procedure. *Surg Obes Relat Dis*. Jul-Aug 2009;5(4):469-475. PMID 19632646
65. Hofso D, Fatima F, Borgeraas H, et al. Gastric bypass versus sleeve gastrectomy in patients with type 2 diabetes (Oseberg): a single-centre, triple-blind, randomised controlled trial. *Lancet Diabetes Endocrinol*. Dec 2019; 7(12): 912-924. PMID 31678062
66. Peterli R, Wolnerhanssen BK, Peters T, et al. Effect of Laparoscopic Sleeve Gastrectomy vs Laparoscopic Roux-en-Y Gastric Bypass on Weight Loss in Patients With Morbid Obesity: The SM-BOSS Randomized Clinical Trial. *JAMA*. Jan 16 2018; 319(3): 255-265. PMID 29340679
67. Salminen P, Helmio M, Ovaska J, et al. Effect of Laparoscopic Sleeve Gastrectomy vs Laparoscopic Roux-en-Y Gastric Bypass on Weight Loss at 5 Years Among Patients With Morbid Obesity: The SLEEVEPASS Randomized Clinical Trial. *JAMA*. Jan 16 2018; 319(3): 241-254. PMID 29340676
68. Helmio M, Victorzon M, Ovaska J, et al. SLEEVEPASS: a randomized prospective multicenter study comparing laparoscopic sleeve gastrectomy and gastric bypass in the treatment of morbid obesity: preliminary results. *Surg Endosc*. Sep 2012;26(9):2521-2526. PMID 22476829
69. Karamanakos SN, Vagenas K, Kalfarentzos F, et al. Weight loss, appetite suppression, and changes in fasting and postprandial ghrelin and peptide-YY levels after Roux-en-Y gastric bypass and sleeve gastrectomy: a prospective, double blind study. *Ann Surg*. Mar 2008;247(3):401-407. PMID 18376181
70. Himpens J, Dapri G, Cadiere GB. A prospective randomized study between laparoscopic gastric banding and laparoscopic isolated sleeve gastrectomy: results after 1 and 3 years. *Obes Surg*. Nov 2006;16(11):1450-1456. PMID 17132410
71. Farrell TM, Haggerty SP, Overby DW, et al. Clinical application of laparoscopic bariatric surgery: an evidence- based review. *Surg Endosc*. May 2009;23(5):930-949. PMID 19125308
72. Skogar ML, Sundbom M. Duodenal Switch Is Superior to Gastric Bypass in Patients with Super Obesity when Evaluated with the Bariatric Analysis and Reporting Outcome System (BAROS). *Obes Surg*. Sep 2017; 27(9): 2308-2316. PMID 28439748
73. Strain GW, Gagner M, Inabnet WB, et al. Comparison of effects of gastric bypass and biliopancreatic diversion with duodenal switch on weight loss and body composition 1-2 years after surgery. *Surg Obes Relat Dis*. Jan- Feb 2007;3(1):31-36. PMID 17116424
74. Prachand VN, Davee RT, Alverdy JC. Duodenal switch provides superior weight loss in the super-obese (BMI > or =50 kg/m<sup>2</sup>) compared with gastric bypass. *Ann Surg*. Oct 2006;244(4):611-619. PMID 16998370
75. Strain GW, Torghabeh MH, Gagner M, et al. Nutrient Status 9 Years After Biliopancreatic Diversion with Duodenal Switch (BPD/DS): an Observational Study. *Obes Surg*. Jul 2017; 27(7): 1709-1718. PMID 28155056
76. Marceau P, Biron S, Hould FS, et al. Duodenal switch improved standard biliopancreatic diversion: a retrospective study. *Surg Obes Relat Dis*. Jan-Feb 2009;5(1):43-47. PMID 18440876
77. Slater GH, Ren CJ, Siegel N, et al. Serum fat-soluble vitamin deficiency and abnormal calcium metabolism after malabsorptive bariatric surgery. *J Gastrointest Surg*. Jan 2004;8(1):48-55; discussion 54-45. PMID 14746835
78. Dolan K, Hatzifotis M, Newbury L, et al. A clinical and nutritional comparison of biliopancreatic diversion with and without duodenal switch. *Ann Surg*. Jul 2004;240(1):51-56. PMID 15213618
79. Skroubis G, Anesidis S, Kehagias I, et al. Roux-en-Y gastric bypass versus a variant of biliopancreatic diversion in a non-superobese population: prospective comparison of the efficacy and the incidence of metabolic deficiencies. *Obes Surg*. Apr 2006;16(4):488-495. PMID 16608616
80. Scopinaro N, Adami GF, Papadia FS, et al. Effects of gastric bypass on type 2 diabetes in patients with BMI 30 to 35. *Obes Surg*. Jul 2014;24(7):1036-1043. PMID 24647849
81. Hsieh T, Zurita L, Grover H, et al. 10-year outcomes of the vertical transected gastric bypass for obesity: a systematic review. *Obes Surg*. Mar 2014;24(3):456-461. PMID 24379176
82. Blue Cross Blue Shield Association Technology Evaluation Center (TEC). TEC Special Report: The relationship between weight loss and changes in morbidity following bariatric surgery for morbid obesity. *TEC Assessments*. 2003;Vol 18:Tab 18.
83. Hall JC, Watts JM, O'Brien PE, et al. Gastric surgery for morbid obesity. The Adelaide Study. *Ann Surg*. Apr 1990;211(4):419-427. PMID 2181950

84. Sugerman HJ, Starkey JV, Birkenhauer R. A randomized prospective trial of gastric bypass versus vertical banded gastroplasty for morbid obesity and their effects on sweets versus non-sweets eaters. *Ann Surg.* Jun 1987;205(6):613-624. PMID 3296971
85. MacLean LD, Rhode BM, Forse RA. Late results of vertical banded gastroplasty for morbid and super obesity. *Surgery.* Jan 1990;107(1):20-27. PMID 2296754
86. Coffin B, Maunoury V, Pattou F, et al. Impact of Intra-gastric Balloon Before Laparoscopic Gastric Bypass on Patients with Super Obesity: a Randomized Multicenter Study. *Obes Surg.* Apr 2017; 27(4): 902-909. PMID 27664095
87. Cottam D, Qureshi FG, Mattar SG, et al. Laparoscopic sleeve gastrectomy as an initial weight-loss procedure for high-risk patients with morbid obesity. *Surg Endosc.* Jun 2006;20(6):859-863. PMID 16738970
88. Alexandrou A, Felekouras E, Giannopoulos A, et al. What is the actual fate of super-morbid-obese patients who undergo laparoscopic sleeve gastrectomy as the first step of a two-stage weight-reduction operative strategy? *Obes Surg.* Jul 26 2012;22(10):1623-1628. PMID 22833137
89. Silecchia G, Rizzello M, Casella G, et al. Two-stage laparoscopic biliopancreatic diversion with duodenal switch as treatment of high-risk super-obese patients: analysis of complications. *Surg Endosc.* May 2009;23(5):1032-1037. PMID 18814005
90. Ji Y, Wang Y, Zhu J, et al. A systematic review of gastric plication for the treatment of obesity. *Surg Obes Relat Dis.* Nov-Dec 2014;10(6):1226-1232. PMID 24582413
91. Talebpour M, Motamedi SM, Talebpour A, et al. Twelve year experience of laparoscopic gastric plication in morbid obesity: development of the technique and patient outcomes. *Ann Surg Innov Res.* Aug 22 2012;6(1):7. PMID 22913751
92. Abdelbaki TN, Huang CK, Ramos A, et al. Gastric plication for morbid obesity: a systematic review. *Obes Surg.* Oct 2012;22(10):1633-1639. PMID 22960951
93. Sullivan S, Swain JM, Woodman G, et al. Randomized sham-controlled trial evaluating efficacy and safety of endoscopic gastric plication for primary obesity: The ESSENTIAL trial. *Obesity (Silver Spring).* Feb 2017; 25(2): 294-301. PMID 28000425
94. Talebpour M, Sadid D, Talebpour A, et al. Comparison of Short-Term Effectiveness and Postoperative Complications: Laparoscopic Gastric Plication vs Laparoscopic Sleeve Gastrectomy. *Obes Surg.* Apr 2018; 28(4): 996-1001. PMID 29043548
95. Pattanshetti S, Tai CM, Yen YC, et al. Laparoscopic adjustable gastric banded plication: evolution of procedure and 2-year results. *Obes Surg.* Nov 2013;23(11):1934-1938. PMID 24013809
96. Shoar S, Poliakin L, Rubenstein R, et al. Single Anastomosis Duodeno-Ileal Switch (SADIS): A Systematic Review of Efficacy and Safety. *Obes Surg.* Jan 2018; 28(1): 104-113. PMID 28823074
97. Torres A, Rubio MA, Ramos-Levi AM, et al. Cardiovascular Risk Factors After Single Anastomosis Duodeno-Ileal Bypass with Sleeve Gastrectomy (SADI-S): a New Effective Therapeutic Approach?. *Curr Atheroscler Rep.* Nov 07 2017; 19(12): 58. PMID 29116413
98. Sanchez-Pernaute A, Rubio MA, Cabrerizo L, et al. Single-anastomosis duodenoileal bypass with sleeve gastrectomy (SADI-S) for obese diabetic patients. *Surg Obes Relat Dis.* Sep-Oct 2015; 11(5): 1092-8. PMID 26048517
99. Rohde U, Hedback N, Gluud LL, et al. Effect of the EndoBarrier Gastrointestinal Liner on obesity and type 2 diabetes: a systematic review and meta-analysis. *Diabetes Obes Metab.* Mar 2016; 18(3): 300-5. PMID 26537317
100. Koehestanie P, de Jonge C, Berends FJ, et al. The effect of the endoscopic duodenal-jejunal bypass liner on obesity and type 2 diabetes mellitus, a multicenter randomized controlled trial. *Ann Surg.* Dec 2014;260(6):984-992. PMID 25072436
101. Saber AA, Shoar S, Almadani MW, et al. Efficacy of First-Time Intra-gastric Balloon in Weight Loss: a Systematic Review and Meta-analysis of Randomized Controlled Trials. *Obes Surg.* Feb 2017; 27(2): 277-287. PMID 27465936
102. Moura D, Oliveira J, De Moura EG, et al. Effectiveness of intra-gastric balloon for obesity: A systematic review and meta-analysis based on randomized control trials. *Surg Obes Relat Dis.* Feb 2016; 12(2): 420-9. PMID 26968503
103. Zheng Y, Wang M, He S, et al. Short-term effects of intra-gastric balloon in association with conservative therapy on weight loss: a meta-analysis. *J Transl Med.* Jul 29 2015; 13: 246. PMID 26219459

104. Kotinda APST, de Moura DTH, Ribeiro IB, et al. Efficacy of Intra-gastric Balloons for Weight Loss in Overweight and Obese Adults: a Systematic Review and Meta-analysis of Randomized Controlled Trials. *Obes Surg.* Jul 2020; 30(7): 2743-2753. PMID 32300945
105. Tate CM, Geliebter A. Intra-gastric Balloon Treatment for Obesity: Review of Recent Studies. *Adv Ther.* Aug 2017; 34(8): 1859-1875. PMID 28707286
106. Ponce J, Woodman G, Swain J, et al. The REDUCE pivotal trial: a prospective, randomized controlled pivotal trial of a dual intra-gastric balloon for the treatment of obesity. *Surg Obes Relat Dis.* Jul-Aug 2015; 11(4): 874-81. PMID 25868829
107. Courcoulas A, Abu Dayyeh BK, Eaton L, et al. Intra-gastric balloon as an adjunct to lifestyle intervention: a randomized controlled trial. *Int J Obes (Lond).* Mar 2017; 41(3): 427-433. PMID 28017964
108. Genco A, Cipriano M, Bacci V, et al. BioEnterics Intra-gastric Balloon (BIB): a short-term, double-blind, randomised, controlled, crossover study on weight reduction in morbidly obese patients. *Int J Obes (Lond).* Jan 2006;30(1):129-133. PMID 16189503
109. Kotzampassi K, Grosomanidis V, Papakostas P, et al. 500 intra-gastric balloons: what happens 5 years thereafter? *Obes Surg.* Jun 2012;22(6):896-903. PMID 22287051
110. Thompson CC, Abu Dayyeh BK, Kushner R, et al. Percutaneous Gastrostomy Device for the Treatment of Class II and Class III Obesity: Results of a Randomized Controlled Trial. *Am J Gastroenterol.* Mar 2017; 112(3): 447-457. PMID 27922026
111. Thompson CC, Abu Dayyeh BK, Kushnir V, et al. Aspiration therapy for the treatment of obesity: 4-year results of a multicenter randomized controlled trial. *Surg Obes Relat Dis.* Aug 2019; 15(8): 1348-1354. PMID 31302000
112. Noren E, Forssell H. Aspiration therapy for obesity; a safe and effective treatment. *BMC Obes.* 2016; 3: 56. PMID 28035287
113. Parmar CD, Gan J, Stier C, et al. One Anastomosis/Mini Gastric Bypass (OAGB-MGB) as revisional bariatric surgery after failed primary adjustable gastric band (LAGB) and sleeve gastrectomy (SG): A systematic review of 1075 patients. *Int J Surg.* Sep 2020; 81: 32-38. PMID 32738545
114. Brethauer SA, Kothari S, Sudan R, et al. Systematic review on reoperative bariatric surgery: American Society for Metabolic and Bariatric Surgery Revision Task Force. *Surg Obes Relat Dis.* Sep-Oct 2014;10(5):952-972. PMID 24776071
115. Almalki OM, Lee WJ, Chen JC, et al. Revisional Gastric Bypass for Failed Restrictive Procedures: Comparison of Single-Anastomosis (Mini-) and Roux-en-Y Gastric Bypass. *Obes Surg.* Apr 2018; 28(4): 970-975. PMID 29101719
116. Sudan R, Nguyen NT, Hutter MM, et al. Morbidity, mortality, and weight loss outcomes after reoperative bariatric surgery in the USA. *J Gastrointest Surg.* Jan 2015;19(1):171-178; discussion 178-179. PMID 25186073
117. Catalano MF, Rudic G, Anderson AJ, et al. Weight gain after bariatric surgery as a result of a large gastric stoma: endotherapy with sodium morrhuate may prevent the need for surgical revision. *Gastrointest Endosc.* Aug 2007;66(2):240-245. PMID 17331511
118. Herron DM, Birkett DH, Thompson CC, et al. Gastric bypass pouch and stoma reduction using a transoral endoscopic anchor placement system: a feasibility study. *Surg Endosc.* Apr 2008;22(4):1093-1099. PMID 18027049
119. Thompson CC, Slattery J, Bundga ME, et al. Peroral endoscopic reduction of dilated gastrojejunal anastomosis after Roux-en-Y gastric bypass: a possible new option for patients with weight regain. *Surg Endosc.* Nov 2006;20(11):1744-1748. PMID 17024527
120. Eid GM, McCloskey CA, Eagleton JK, et al. StomaphyX vs a sham procedure for revisional surgery to reduce regained weight in Roux-en-Y gastric bypass patients: a randomized clinical trial. *JAMA Surg.* Apr 2014;149(4):372-379. PMID 24554030
121. Dakin GF, Eid G, Mikami D, et al. Endoluminal revision of gastric bypass for weight regain--a systematic review. *Surg Obes Relat Dis.* May-Jun 2013;9(3):335-342. PMID 23561960
122. Cohen RV, Oliveira da Costa MV, Charry L, et al. Endoscopic gastroplasty to treat medically uncontrolled obesity needs more quality data: A systematic review. *Surg Obes Relat Dis.* Jul 2019; 15(7): 1219-1224. PMID 31130406
123. Wu GZ, Cai B, Yu F, et al. Meta-analysis of bariatric surgery versus non-surgical treatment for type 2 diabetes mellitus. *Oncotarget.* Dec 27 2016; 7(52): 87511-87522. PMID 27626180

124. Mingrone G, Panunzi S, De Gaetano A, et al. Bariatric-metabolic surgery versus conventional medical treatment in obese patients with type 2 diabetes: 5 year follow-up of an open-label, single-centre, randomised controlled trial. *Lancet*. Sep 05 2015; 386(9997): 964-73. PMID 26369473
125. Muller-Stich BP, Senft JD, Warschkow R, et al. Surgical versus medical treatment of type 2 diabetes mellitus in nonseverely obese patients: a systematic review and meta-analysis. *Ann Surg*. Mar 2015;261(3):421-429. PMID 25405560
126. Rao WS, Shan CX, Zhang W, et al. A meta-analysis of short-term outcomes of patients with type 2 diabetes mellitus and BMI  $\leq$  35 kg/m<sup>2</sup> undergoing Roux-en-Y gastric bypass. *World J Surg*. Jan 2015;39(1):223-230. PMID 25159119
127. Blue Cross Blue Shield Association Technology Evaluation Center (TEC). Bariatric Surgery In Patients With Diabetes And Body Mass Index Less Than 35 kg/m<sup>2</sup> TEC Assessments. 2012;Volume 27:Tab 2.
128. Cummings DE, Cohen RV. Bariatric/Metabolic Surgery to Treat Type 2 Diabetes in Patients With a BMI 35 kg/m<sup>2</sup>. *Diabetes Care*. Jun 2016; 39(6): 924-33. PMID 27222550
129. Cummings DE, Rubino F. Metabolic surgery for the treatment of type 2 diabetes in obese individuals. *Diabetologia*. Feb 2018; 61(2): 257-264. PMID 29224190
130. Simonson DC, Vernon A, Foster K, et al. Adjustable gastric band surgery or medical management in patients with type 2 diabetes and obesity: three-year results of a randomized trial. *Surg Obes Relat Dis*. Dec 2019; 15(12): 2052-2059. PMID 31931977
131. Ikramuddin S, Billington CJ, Lee WJ, et al. Roux-en-Y gastric bypass for diabetes (the Diabetes Surgery Study): 2-year outcomes of a 5-year, randomised, controlled trial. *Lancet Diabetes Endocrinol*. Jun 2015; 3(6): 413-422. PMID 25979364
132. Liang Z, Wu Q, Chen B, et al. Effect of laparoscopic Roux-en-Y gastric bypass surgery on type 2 diabetes mellitus with hypertension: a randomized controlled trial. *Diabetes Res Clin Pract*. Jul 2013;101(1):50-56. PMID 23706413
133. Courcoulas AP, Belle SH, Neiberg RH, et al. Three-Year Outcomes of Bariatric Surgery vs Lifestyle Intervention for Type 2 Diabetes Mellitus Treatment: A Randomized Clinical Trial. *JAMA Surg*. Oct 2015; 150(10): 931-40. PMID 26132586
134. Courcoulas AP, Gallagher JW, Neiberg RH, et al. Bariatric Surgery vs Lifestyle Intervention for Diabetes Treatment: 5-Year Outcomes From a Randomized Trial. *J Clin Endocrinol Metab*. Mar 01 2020; 105(3). PMID 31917447
135. Schauer PR, Bhatt DL, Kirwan JP, et al. Bariatric Surgery versus Intensive Medical Therapy for Diabetes - 5-Year Outcomes. *N Engl J Med*. Feb 16 2017; 376(7): 641-651. PMID 28199805
136. Wentworth JM, Playfair J, Laurie C, et al. Multidisciplinary diabetes care with and without bariatric surgery in overweight people: a randomised controlled trial. *Lancet Diabetes Endocrinol*. Jul 2014;2(7):545-552. PMID 24731535
137. Halperin F, Ding SA, Simonson DC, et al. Roux-en-Y gastric bypass surgery or lifestyle with intensive medical management in patients with type 2 diabetes: feasibility and 1-year results of a randomized clinical trial. *JAMA Surg*. Jul 2014;149(7):716-726. PMID 24899464
138. Lanzarini E, Csendes A, Gutierrez L, et al. Type 2 diabetes mellitus in patients with mild obesity: preliminary results of surgical treatment. *Obes Surg*. Feb 2013;23(2):234-240. PMID 23054574
139. Boza C, Munoz R, Salinas J, et al. Safety and efficacy of Roux-en-Y gastric bypass to treat type 2 diabetes mellitus in non-severely obese patients. *Obes Surg*. Sep 2011;21(9):1330-1336. PMID 21744283
140. DePaula AL, Stival AR, DePaula CC, et al. Surgical treatment of type 2 diabetes in patients with BMI below 35: mid-term outcomes of the laparoscopic ileal interposition associated with a sleeve gastrectomy in 202 consecutive cases. *J Gastrointest Surg*. May 2012;16(5):967-976. PMID 22350720
141. Lee WJ, Wang W, Lee YC, et al. Effect of laparoscopic mini-gastric bypass for type 2 diabetes mellitus: comparison of BMI  $>$ 35 and  $<$ 35 kg/m<sup>2</sup>. *J Gastrointest Surg*. May 2008;12(5):945-952. PMID 17940829
142. Blue Cross Blue Shield Association Technology Evaluation Center (TEC). Laparoscopic adjustable gastric banding in patients with body mass index less than 35 kg/m<sup>2</sup> with weight-related comorbidity. TEC Assessments. 2012;Volume 27:Tab 3.

143. Qi L, Guo Y, Liu CQ, et al. Effects of bariatric surgery on glycemic and lipid metabolism, surgical complication and quality of life in adolescents with obesity: a systematic review and meta-analysis. *Surg Obes Relat Dis*. Dec 2017; 13(12): 2037-2055. PMID 29079384
144. Black JA, White B, Viner RM, et al. Bariatric surgery for obese children and adolescents: a systematic review and meta-analysis. *Obes Rev*. Aug 2013;14(8):634-644. PMID 23577666
145. Treadwell JR, Sun F, Schoelles K. Systematic review and meta-analysis of bariatric surgery for pediatric obesity. *Ann Surg*. Nov 2008;248(5):763-776. PMID 18948803
146. Dumont PN, Blanchet MC, Gignoux B, et al. Medium- to Long-Term Outcomes of Gastric Banding in Adolescents: a Single-Center Study of 97 Consecutive Patients. *Obes Surg*. Jan 2018; 28(1): 285-289. PMID 29103071
147. Inge TH, Zeller MH, Jenkins TM, et al. Perioperative outcomes of adolescents undergoing bariatric surgery: the Teen-Longitudinal Assessment of Bariatric Surgery (Teen-LABS) study. *JAMA Pediatr*. Jan 2014;168(1):47-53. PMID 24189578
148. Olbers T, Beamish AJ, Gronowitz E, et al. Laparoscopic Roux-en-Y gastric bypass in adolescents with severe obesity (AMOS): a prospective, 5-year, Swedish nationwide study. *Lancet Diabetes Endocrinol*. Mar 2017; 5(3): 174-183. PMID 28065734
149. Willcox K, Brennan L. Biopsychosocial outcomes of laparoscopic adjustable gastric banding in adolescents: a systematic review of the literature. *Obes Surg*. Sep 2014;24(9):1510-1519. PMID 24849913
150. Nadler EP, Youn HA, Ren CJ, et al. An update on 73 US obese pediatric patients treated with laparoscopic adjustable gastric banding: comorbidity resolution and compliance data. *J Pediatr Surg*. Jan 2008;43(1):141-146. PMID 18206472
151. Manco M, Mosca A, De Peppo F, et al. The Benefit of Sleeve Gastrectomy in Obese Adolescents on Nonalcoholic Steatohepatitis and Hepatic Fibrosis. *J Pediatr*. Jan 2017; 180: 31-37.e2. PMID 27697327
152. August GP, Caprio S, Fennoy I, et al. Prevention and treatment of pediatric obesity: an Endocrine Society clinical practice guideline based on expert opinion. *J Clin Endocrinol Metab*. Dec 2008;93(12):4576-4599. PMID 18782869
153. Greenstein RJ, Nissan A, Jaffin B. Esophageal anatomy and function in laparoscopic gastric restrictive bariatric surgery: implications for patient selection. *Obes Surg*. Apr 1998;8(2):199-206. PMID 9730394
154. Pilone V, Vitiello A, Hasani A, et al. Laparoscopic adjustable gastric banding outcomes in patients with gastroesophageal reflux disease or hiatal hernia. *Obes Surg*. Feb 2015;25(2):290-294. PMID 25030091
155. Gulkarov I, Wetterau M, Ren CJ, et al. Hiatal hernia repair at the initial laparoscopic adjustable gastric band operation reduces the need for reoperation. *Surg Endosc*. Apr 2008;22(4):1035-1041. PMID 18080712
156. Santonicola A, Angrisani L, Cutolo P, et al. The effect of laparoscopic sleeve gastrectomy with or without hiatal hernia repair on gastroesophageal reflux disease in obese patients. *Surg Obes Relat Dis*. Mar-Apr 2014;10(2):250-255. PMID 24355324
157. Reynoso JF, Goede MR, Tiwari MM, et al. Primary and revisional laparoscopic adjustable gastric band placement in patients with hiatal hernia. *Surg Obes Relat Dis*. May-Jun 2011;7(3):290-294. PMID 21130046
158. Ardestani A, Tavakkoli A. Hiatal hernia repair and gastroesophageal reflux disease in gastric banding patients: analysis of a national database. *Surg Obes Relat Dis*. May-Jun 2014;10(3):438-443. PMID 24680760
159. Frezza EE, Barton A, Wachtel MS. Crural repair permits morbidly obese patients with not large hiatal hernia to choose laparoscopic adjustable banding as a bariatric surgical treatment. *Obes Surg*. May 2008;18(5):583-588. PMID 18317857
160. al-Haddad BJ, Dorman RB, Rasmus NF, et al. Hiatal hernia repair in laparoscopic adjustable gastric banding and laparoscopic Roux-en-Y gastric bypass: a national database analysis. *Obes Surg*. Mar 2014;24(3):377-384. PMID 24307434
161. Garber AJ, Handelsman Y, Grunberger G, et al. CONSENSUS STATEMENT BY THE AMERICAN ASSOCIATION OF CLINICAL ENDOCRINOLOGISTS AND AMERICAN COLLEGE OF

- ENDOCRINOLOGY ON THE COMPREHENSIVE TYPE 2 DIABETES MANAGEMENT ALGORITHM - 2020 EXECUTIVE SUMMARY. *Endocr Pract.* Jan 2020; 26(1): 107-139. PMID 32022600
162. Garvey WT, Mechanick JI, Brett EM, et al. AMERICAN ASSOCIATION OF CLINICAL ENDOCRINOLOGISTS AND AMERICAN COLLEGE OF ENDOCRINOLOGY COMPREHENSIVE CLINICAL PRACTICE GUIDELINES FOR MEDICAL CARE OF PATIENTS WITH OBESITYEXECUTIVE SUMMARYComplete Guidelines available at <https://www.aace.com/publications/guidelines>. *Endocr Pract.* Jul 2016; 22(7): 842-84. PMID 27472012
163. Mechanick JI, Apovian C, Brethauer S, et al. CLINICAL PRACTICE GUIDELINES FOR THE PERIOPERATIVE NUTRITION, METABOLIC, AND NONSURGICAL SUPPORT OF PATIENTS UNDERGOING BARIATRIC PROCEDURES - 2019 UPDATE: COSPONSORED BY AMERICAN ASSOCIATION OF CLINICAL ENDOCRINOLOGISTS/AMERICAN COLLEGE OF ENDOCRINOLOGY, THE OBESITY SOCIETY, AMERICAN SOCIETY FOR METABOLIC BARIATRIC SURGERY, OBESITY MEDICINE ASSOCIATION, AND AMERICAN SOCIETY OF ANESTHESIOLOGISTS - EXECUTIVE SUMMARY. *Endocr Pract.* Dec 2019; 25(12): 1346-1359. PMID 31682518
164. Ali MR, Moustarah F, Kim JJ. American Society for Metabolic and Bariatric Surgery position statement on intragastric balloon therapy endorsed by the Society of American Gastrointestinal and Endoscopic Surgeons. *Surg Obes Relat Dis.* Mar-Apr 2016; 12(3): 462-467. PMID 27056407
165. Ali M, El Chaar M, Ghiassi S, et al. American Society for Metabolic and Bariatric Surgery updated position statement on sleeve gastrectomy as a bariatric procedure. *Surg Obes Relat Dis.* Oct 2017; 13(10): 1652-1657. PMID 29054173
166. Kallies K, Rogers AM. American Society for Metabolic and Bariatric Surgery updated statement on single-anastomosis duodenal switch. *Surg Obes Relat Dis.* Jul 2020; 16(7): 825-830. PMID 32371036
167. Mahawar KK, Himpens JM, Shikora SA, et al. The first consensus statement on revisional bariatric surgery using a modified Delphi approach. *Surg Endosc.* Apr 2020; 34(4): 1648-1657. PMID 31218425
168. Childerhose JE, Alsamawi A, Mehta T, et al. Adolescent bariatric surgery: a systematic review of recommendation documents. *Surg Obes Relat Dis.* Oct 2017; 13(10): 1768-1779. PMID 28958402
169. Michalsky M, Reichard K, Inge T, et al. ASMBS pediatric committee best practice guidelines. *Surg Obes Relat Dis.* Jan-Feb 2012;8(1):1-7. PMID 22030146
170. Nobili V, Vajro P, Dezsofi A, et al. Indications and limitations of bariatric intervention in severely obese children and adolescents with and without nonalcoholic steatohepatitis: ESPGHAN Hepatology Committee Position Statement. *J Pediatr Gastroenterol Nutr.* Apr 2015;60(4):550-561. PMID 25591123
171. Centers for Medicare and Medicaid Services (CMS). Decision Memo for Bariatric Surgery for the Treatment of Morbid Obesity (CAG-00250R). 2006; <https://www.cms.gov/medicare-coverage-database/details/nca-decision-memo.aspx?NCAId=160>. Accessed December 16, 2020.

## Endnotes

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<sup>1</sup> Based on expert opinion