REVIEW

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Bariatric surgery for morbid obesity: Why, who, when, how, where, and then what?

ABSTRACT

Bariatric surgery is not a cure, but it can take weight off and keep it off, improve most obesity-related conditions, reduce the risk of premature death, and improve quality of life. Given the interest in the procedure, primary care physicians need to understand the risks and benefits to help patients determine if this therapy is a good option, and they need to know the health changes that may occur after surgery when following these patients.

KEY POINTS

Bariatric surgery is currently the only effective therapy for morbid obesity.

Benefits of surgery, although not universal, include durable weight loss, resolution of type 2 diabetes, improvement in hypertension, improved cardiovascular profile, and lower risk of premature death.

While prior weight loss attempts are an accepted prerequisite for bariatric surgery, the clinician must ultimately judge when enough is enough.

Surgery is only one part of a long-term, multidisciplinary approach that should include a plan for lifelong follow-up, including monitoring for nutritional and metabolic complications, and dietary counseling to prevent weight gain.

Rates of perioperative complications and death are low, although wound problems in obese patients are more common. Most complications are manageable, especially if promptly diagnosed.

BARIATRIC SURGERY can take weight off and keep it off, but it is not a cure, and it is not for everyone. Nevertheless, given the increasing prevalence of obesity and the limited effectiveness of diet therapy in morbidly obese people, there has been tremendous public interest in surgery for obesity.

As a result, primary care physicians are encountering more patients who are contemplating or have undergone these procedures. Many are requesting preoperative evaluation or returning for primary care follow-up after surgery.

To care for these patients effectively, primary care physicians need to know:

- **Why** the surgery is needed
- **Who** are the best candidates for bariatric surgery
- **When** patients should consider bariatric surgery
- **How** the surgery should be performed: that is, which procedure is best for which patient
- **Where** the procedure should be performed: that is, how can you help a patient select a surgeon
- **Then what** to watch for in patients who have had bariatric surgery.

WHY?

Obesity on the rise

The prevalence of obesity is increasing worldwide at an alarming rate.[1] In the United States, obesity is already the most common chronic disease, affecting one third of American adults.[2] It also appears to be increas-

ing in Europe, Australia, New Zealand, the Middle East, and the rest of the Americas, where the prevalence is now between 10% and 20%.

According to former US Surgeon General David Satcher,[3] a staggering 61% of American adults meet the criteria for overweight or obesity and so are at increased risk of heart disease, diabetes, stroke, arthritis, depression, and several forms of cancer. As many as 300,000 deaths each year in the United States are associated with unhealthy diets and lack of physical activity—a number that rivals the 400,000 smoking-related deaths each year.

61% of American adults are overweight or obese

Benefits of surgery

Durable weight loss is the primary benefit of bariatric surgery. Patients lose an average of 40% to 75% of excess body weight, depending on the specific procedure. This equals about 30% to 40% of the initial weight.[4–8]

Surgical treatment is considered successful if 50% of the patient's excess weight is still off at least 5 years after the procedure. By this definition, gastric bypass (also called the "Roux-en-Y procedure"), for example, has approximately a 70% success rate.[5–8]

But perhaps more significant than the weight reduction is the impact of bariatric surgery on obesity-related conditions.

Resolution of type 2 diabetes. One group[5,6,8] demonstrated profound and very rapid resolution of type 2 diabetes mellitus, with normalization of glucose tolerance in 78% of patients.

Improvement in hypertension has also been noted. Although the changes were not as profound as for type 2 diabetes, about half of hypertensive patients became normotensive after surgery, and medication requirements were decreased.[9–11]

Cardiovascular benefits are well documented. Improved ventricular function, reduced myocardial wall thickness and chamber size, and sustained normalization of lipid profiles are common.[12–16]

Obstructive sleep apnea and the more severe obesity hypoventilation syndrome are markedly improved after bariatric surgery. Apneic episodes are reduced to minimal in 70% of patients and are eliminated altogether in 40%.[17,18]

Benign intracranial hypertension or pseudotumor cerebri, which causes headaches and visual field changes, also improves.[19,20]

Lower risk of premature death. MacDonald et al[5] noted a much lower mortality rate over 6 years in patients who underwent surgical treatment of obesity vs patients who were medically approved for surgery but did not undergo it (9% vs 28%, including perioperative deaths); and for every year of follow-up, patients who had surgery had a 1.0% chance of dying vs 4.5% in patients who did not have surgery. Surgically treated patients also had a markedly lower rate of progression of diabetes mellitus.

Improved quality of life was documented in many studies, which used a variety of assessment tools. Patients report increases in physical activity and sexual interest,[21] and health care providers and patients report improved perceptions of health.[22]

Lower disability and health care costs. The economic implications of successful surgical treatment of morbidly obese patients are profound.[23] Martin et al[11] found that 18 (45%) of 40 patients receiving disability or public assistance before surgery found full-time or part-time employment afterward. A Swedish study of obese patients found that the surgery pays for itself in about 3 years if we consider reductions in health care expenditures, the return of patients to work, and the contributions of patients to the tax base.

WHO?

Candidates for bariatric surgery must be morbidly obese, have an acceptable level of surgical risk, and be psychologically stable.

Morbid obesity

Morbid obesity, the most extreme and life-threatening form of obesity, has been defined in several ways.

The body mass index, the preferred standard to define obesity and to delineate its severity, is calculated as the weight in kilograms divided by the height in meters squared (kg/m^2). (To use pounds and inches, multiply the weight in pounds by 705, then divide by the height in inches squared.) Patients with a body mass index greater than 30 kg/m^2 are

considered obese.[24] Surgery is an option in patients with a body mass index of 40 or more, or a body mass index greater than 35 plus an obesity-related condition.

The "ideal body weight" used in life insurance tables or estimated from height was formerly used as the basis for defining overweight and morbid obesity. Morbid obesity was defined as 100 pounds over ideal weight, 200% of ideal weight, or twice the ideal body weight. However, the ideal weight may differ according to one's culture, and data from populations with life insurance are not always applicable to the general population. Body mass index is a more objective measure.

Contraindications

General contraindications for bariatric surgery are the same as those for any elective abdominal operation. Psychologically unstable patients are poor candidates, as are patients with concomitant medical conditions that make general anesthesia prohibitively risky.

Eating disorders should be carefully treated before considering surgery, because bariatric procedures, especially ones that alter the size of the stomach to restrict food intake, may exacerbate bulimia or anorexia nervosa. A history of true anorexia nervosa is generally considered a contraindication.

Pregnancy should be delayed until the body weight stabilizes, generally 18 to 24 months after surgery; therefore, effective contraception is strongly encouraged during this period.

WHEN?

The average patient considering bariatric surgery has made six serious attempts to lose weight by dieting, often with adjuvant drug therapy. With or without drugs, people can lose approximately 10% to 12% of their initial weight over 6 to 12 months of dieting. Maintaining weight loss remains the biggest obstacle: most patients regain all weight lost by 5 years.[25]

Most guidelines include prior weight-loss attempts as a criterion for surgical consideration. However, the low success rates of nonsurgical therapy in morbidly obese patients,[26] coupled with the urgency posed by their associated health problems, require medical judgment of when "enough is enough." The American Heart Association guidelines reflect this view,[27] advocating surgery as the treatment of choice for patients with a body mass index greater than 40 kg/m^2.

HOW?

Current bariatric procedures mainly involve the stomach and, to varying degrees, the small intestine.

Restrictive procedures

Restrictive procedures, such as gastric banding and vertical banded gastroplasty (FIGURE 1), decrease the size of the stomach by division, partitioning, or removal. They work solely by creating satiety: patients can eat only a small amount before they feel full, but the food is fully absorbed.

The amount of stomach removed or excluded partly determines the degree of restriction. The outlet of the gastric pouch that is formed is small, usually 8 to 10 mm; this helps delay emptying and also contributes to the degree of restriction.

Patients lose 40% to 75% of excess weight after bariatric surgery

Malabsorptive procedures

Malabsorptive procedures involve bypassing (or in some cases removing) some portion of the gastrointestinal tract so that nutrients consumed cannot be completely absorbed.

Jejunoileal bypass, also called intestinal bypass, was an early bariatric procedure that short-circuited the small intestine, joining the first 8 inches of jejunum to the last 12 inches of ileum. As such, it was a purely malabsorptive procedure. The excluded limb of small bowel was vented to the colon or small intestine and, therefore, was not obstructed; however, no food or intestinal secretions passed through it. This "blind" loop and the profound malabsorption that this operation caused resulted in a myriad of problems that led to the procedure being abandoned.

Gastric bypass (the Roux-en-Y procedure)

Gastric bypass has restrictive and malabsorptive features.

In this procedure, the small intestine is reconfigured into a Y (FIGURE 1). The proximal

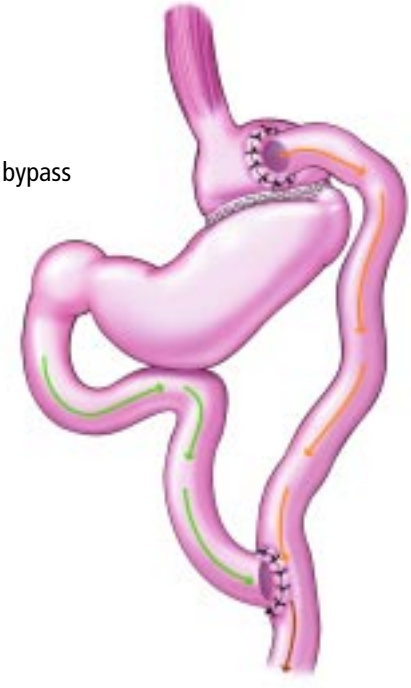
Bariatric surgery for morbid obesity: Common techniques

Gastric banding

Restrictive procedures such as gastric banding and vertical banded gastroplasty decrease the size of the stomach, usually by division or partitioning. They work solely by creating early satiety. The food ingested is fully absorbed.

Vertical banded gastroplasty

Gastric bypass



Gastric bypass, or the Roux-en-Y procedure, promotes early satiety but also promotes malabsorption of food that is ingested. The small intestine is reconfigured into a Y, consisting of two limbs and a common channel. The pancreo-biliary limb is proximal small bowel, still attached to the stomach and the duodenum, that drains bile, digestive enzymes, and gastric secretions. The food limb or Roux limb is attached to and drains the small gastric pouch. At the junction of these two limbs, the food mixes with the digestive juices and then proceeds along the common channel toward the colon.

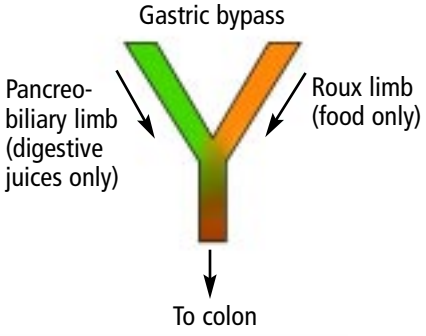


FIGURE 1

small bowel remains attached to the stomach and duodenum below the gastric division or partition. This limb is called the pancreo-biliary conduit (or limb), and it drains bile, digestive enzymes, and gastric secretions.

The other limb, sometimes called the Roux limb, is attached to and drains the small proximal gastric pouch, and so carries only food. The Y is created at the point where the pancreo-biliary conduit and the Roux limb are connected. At this point the digestive juices and food mix and go on together, passing through the remaining arm of the Y, known as the common channel.

The gastric pouch tends to be very small and, hence, is quite restrictive: it can hold only about an ounce of food. The degree of malabsorption, on the other hand, is related to the length of the common channel and to the combined length of the common channel and the Roux limb. (On average, adults have about 600 cm of small bowel; increasing the length of one limb decreases the length of the other two limbs.)

Which procedure to use?

The choice of a more malabsorptive procedure as the initial intervention is primarily the preference of the surgeon, with discussion with the patient of the additional risk involved (see below). Some suggest more malabsorptive procedures for extremely morbidly obese patients (body mass index ≥ 60), whereas others use these as salvage procedures for patients who do not lose enough weight after a restrictive procedure, to improve their comorbid conditions.

Laparoscopic or open surgery?

Wittgrove et al[28] reported their first series of patients with laparoscopic gastric bypass in 1994. Other procedures that have been done laparoscopically include vertical banded gastroplasty, duodenal switch, biliopancreatic diversion, and the newer adjustable banding procedures.[29]

Surgeons have been slow to adopt the laparoscopic approach to bariatric surgery, however, as it is technically more difficult than, say, laparoscopic cholecystectomy (which was introduced in the early 1990s and was widely adopted within the next 2 to 3 years).

Therefore, most bariatric procedures are still done in an open fashion via a 6-inch to 8-inch abdominal incision. However, whether bariatric surgery is done laparoscopically or via an open approach is less important than the choice of procedure to be performed.

WHERE?

Once the decision is made to refer the patient for bariatric surgery, the next steps are to select a center and a surgeon and to inform the patient about the perioperative risks.

What surgeon?

The surgeon selected should perform enough procedures per year to remain technically adept, maintain technical expertise among the staff of the operating room and surgical ward, and maintain skill in the perioperative and postoperative care of obese surgical patients.

What are the risks?

Perioperative risks are similar to those of any procedure involving the abdominal gastrointestinal tract and lasting 1 to 2 hours.

Wound problems are more common in morbidly obese patients; these include infections, seromas, and hernias.[30] The incidence of wound problems following bariatric surgery is about 15%.

Gastrojejunostomy leak is the most feared complication, but this or any other gastrointestinal anastomotic leak occurs in fewer than 1% of cases, and if it is quickly recognized, it is usually successfully managed.

Venous thromboembolism occurs in fewer than 1% of cases if preventive measures are taken, and the incidence of fatal pulmonary embolism is about 2 in 1,000. Measures to prevent perioperative thromboembolism include low-dose heparin, pneumatic compression stockings, and early ambulation.

Death. Overall mortality rates should be less than 1%.

Other care issues

Surgeons who perform bariatric procedures should espouse a long-term, multidisciplinary approach to the treatment of morbid obesity.

After dieting, most people regain all weight lost within 5 years

Preoperative and postoperative care includes:

- A follow-up assessment to ensure that the pouch, stoma, anastomoses, and staple lines are still intact
- Nutrition education and assessment
- Access to mental health providers
- A plan for lifelong follow-up.

Patients should have the opportunity to join support groups and undergo exercise assessment and planning. Issues such as morbidity and mortality should be discussed, using actual data. Long-term care and follow-up are as essential as a well-performed procedure.

The primary care physician continues to play an important role in the patient's ongoing care, and good communication between the primary care physician and the surgeon is essential. We strongly condemn the practice of "dumping" the patient back to the primary care physician for all follow-up care.

THEN WHAT? LONG-TERM CONCERNS

Long-term concerns in bariatric surgery patients include nutritional and metabolic complications and maintaining weight loss.

Indications for surgery:
•BMI ≥ 40, or
•BMI ≥ 35 plus obesity-related condition

Nutritional and metabolic complications

Nutritional and metabolic complications are rare, but they occur often enough that a regular screening plan is appropriate. The incidence of complications depends in part on the type of procedure.

Protein calorie malnutrition. The risk of protein calorie malnutrition (muscle wasting, reduced serum albumin and total protein) is greater when the malabsorptive segment (ie, the common channel in gastric bypass) is shorter. When the common channel is approximately 50 cm, the incidence of protein calorie malnutrition is about 26%.[31] When it is 75 cm, the incidence is 13%. When it is 150 cm, the incidence is 8%.[32] And when it is longer than 200 cm, the incidence is less than 1%.

To detect protein calorie malnutrition, patients with more distal procedures should have their serum albumin levels monitored 3 to 4 times per year in the first 3 to 4 years, and then annually.

Protein calorie malnutrition can also occur with standard gastric bypass (common channel > 200 cm) or vertical banded gastroplasty if there is excessive vomiting or if the patient will not eat.

Vitamin and mineral deficiencies. Iron, folate, and vitamin B_{12} absorption decreases after all procedures that bypass the lower stomach and proximal small bowel. Therefore, all patients need to take a multivitamin supplement. However, even with supplementation, iron and vitamin B_{12} deficiency may occur. Iron deficiency may occur in 20% to 50% of patients, and menstruating women are at greatest risk. Vitamin B_{12} deficiency occurs in 25% to 35% of patients and thus warrants monitoring and treatment.[33]

Iron, vitamin B_{12}, and the blood count should be monitored twice a year in the first 2 years and then annually.

Fat malabsorption increases as length of the common channel decreases. If the common channel is shorter than 150 cm, the degree of malabsorption warrants daily supplementation with the fat-soluble vitamins A (25,000 U) and D (50,000 U).

The absorption of medications is normal.

Keeping the lost weight off

Bariatric procedures palliate rather than cure obesity, so maintaining weight loss after bariatric surgery remains a concern. Often, dietary education is the key to getting patients back on track.

If the patient continues to gain weight, a workup is warranted to assess that the procedure is still intact—for example, if the stomach was stapled shut, to determine that the staple line is still intact.

Conversion or revision procedures are much more complex than the initial bariatric operation and should be performed only by experienced bariatric surgeons.

Occasionally, revision of the pouch or stoma is required, but if these appear intact, conversion of a standard gastric bypass to a more distal procedure is sometimes considered. This procedure involves only the small bowel and, for this reason, it is fairly simple and presents a lower operative risk. In addition, it often can restore weight loss.[32] These patients also require an increase in follow-up care because of the increased risks related to the malabsorption.

If weight loss or malnutrition is excessive

Excessive weight loss is almost never a problem. Weight regain or inadequate weight loss is the more common scenario.

However, malabsorptive procedures can result in malnutrition, and a small percentage of patients require surgical revision to increase their absorptive capacity.

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After gastric bypass, monitor:
- **Folate**
- **Iron**
- **Vitamin B_{12}**
- **CBC**