The SAGES Manual

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A Practical Guide to Bariatric Surgery

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Preface

The field of bariatric surgery has grown at an exponential rate over the past decade. The number of bariatric operations has increased from less than 10,000 operations in 1998 to nearly 200,000 operations in 2008. Bariatric surgery has become an integral part of gastrointestinal surgery and is now an important part of education for surgical residents and fellows in minimally invasive surgery. Educational initiatives in bariatric surgery take many different forms and currently many textbooks on the topic of bariatric surgery are commercially available. However, there is a need for a quick-reference manual that provides up-to-date, easy access to information about this new and complex surgical specialty.

The SAGES Manual: A Practical Guide to Bariatric Surgery began as a project developed within the SAGES Bariatric Liaison group. The name of the book previews its primary purpose, as it is meant to provide practical information within a small pocket-sized book that can serve as a portable resource anywhere, including the ward and clinic. This manual provides a concise, practical guide to promote high-quality, safe care for patients undergoing weight loss surgery. It is intended to be used by any members of the multidisciplinary team, including surgeons, surgeons-in-training, medical physicians, medical students, nurses, nurse practitioners, physician's assistants, nutritionists, and psychologists.

We would like to thank members of the SAGES Bariatric Liaison group who have contributed to the manual, the SAGES leadership whose support and encouragement were critical for its development, and Springer for helping to make this project a reality. Our goal is that knowledge gained from using this manual will help to promote safe and effective care for patients undergoing bariatric surgery.

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I. Essentials of Bariatric Surgery

1. The Rationale for Bariatric Surgery

Xingxiang Li, Orit Kaidar-Person, and Raul J. Rosenthal

A. Introduction

The aim of these guidelines is to systematically review the clinical effectiveness of the various bariatric surgical procedures and support bariatric surgeons and allied physicians in the provision of high-quality care for morbidly obese patients.

Obesity is a serious worldwide health problem. It has been shown to predispose to various diseases, particularly cardiovascular disease, diabetes mellitus, sleep apnea, and osteoarthritis. Studies have shown that obesity is an important independent risk factor for morbidity and mortality from coronary disease; consequently, the American Heart Association continues to emphasize the importance of obesity as a major modifiable risk factor in the treatment of coronary artery disease. In the United States, the mortality rate from obesity exceeds 400,000 patients a year, and obesity is considered to be the second cause of preventable death after cigarette smoking. The long-term implications of obesity are detrimental to patients' health and are costly. It is estimated that the annual cost spent on the treatment of obesity and obesity-related health problems exceeds $100 billion. Despite various pharmacological treatments, diets, exercise, and behavioral therapy, most patients regain all lost weight within a period of 2 years.

Obesity is a disease in which the natural energy reserve, stored as fat, is increased to a point where it compromises the patient's state of being. The etiology of obesity is multifactorial, and is related to genotypic and environmental factors. Environmental factors such as social and cultural aspects, in association with genotypic factors, cause the abnormal physiology, metabolism, and behavioral and psychological pathways that result in the obesity phenotype.

The definition and classification of obesity is primarily based on the body mass index (BMI), calculated as weight divided by the square of height, by means of kilograms per square meter as the unit of measurement. Body mass index provides a reliable indicator of the level of fat in the body for most people (but not athletes), and is used to screen for weight categories that may lead to health problems. For example, Caucasians with a BMI of 30–35 kg/m^2 is considered as class 1 obesity, 35–40 kg/m^2 as class 2, and >40 kg/m^2 as class 3. Morbid obesity is usually defined as a BMI ≥ 40 kg/m^2 or a BMI ≥ 35 kg/m^2 in patients with comorbidities. In addition, in some cases, patients are defined as suffering from super- and mega-obesity, if their BMI >50 or 70 kg/m^2, respectively. Alternatively, absolute or relative increase in body weight may be used to define obesity.

Morbid obesity is a debilitating disease; it imposes physiological–psychological stress and is often associated with social isolation, depression, and other psychological and somatic comorbidities. These include metabolic complications

(type II diabetes, fatty liver, cholelithiasis and hyperlipidemia), hypertension, ischemic heart disease, arthritis and respiratory system complications (obesity-hypoventilation syndrome and sleep apnea syndrome). Other common comorbidities include joint degeneration, endocrine disorders including sex hormone secretion disorders, vein congestion, and deep vein thrombosis. Disturbingly, obesity has been ignored for decades, although there is considerable evidence that suggests that obesity plays an important role in cancer pathogenesis. Obesity has been clearly associated with increased risks for kidney cancer in both genders, and in endometrial cancer and postmenopausal breast cancer in women. Studies suggest that obesity and overweight also are related to increase risk of colorectal cancer and gall bladder cancer. Obesity and overweight are often associated with gastric-reflux disease; thus, obesity may play an important role in the increasing incidence of esophageal cancer. Obesity as a predisposing factor for thyroid cancer and prostate cancer is still under evaluation.

In a recent study, the association between different grades of obesity and the number of life-years lost indicated that life expectancy is up to 20 years shorter in severe obesity. The World Health Organization (WHO) considers obesity to be the fifth major unhealthful dangerous factor because it brings inestimably potential health problems. Therefore, awareness and aggressive intervention are imperative in order to improve the patients' well-being.

B. Treatment Selection and Indications for Surgery

Weight reduction should be an integral part of any treatment regimen. Studies have confirmed that obesity is far more complex than overindulgence. These patients usually suffer from a complex disorder with genetic, metabolic, hormonal, psychosocial, and perhaps central nervous system disturbances. What is more troubling is that the pathogenesis of this disease is poorly understood and varies from patient to patient, making conventional treatment options more complicated and often unsuccessful. Weight loss can be achieved by various measures, such as nutritional modification, exercise, drugs, and bariatric surgery. Bariatric surgery has been found in numerous studies to be the most efficacious long-term treatment option for weight reduction, resulting in improvement or complete remission of comorbidities.

Surgical therapy should be considered for individuals with a BMI $>40\,kg/m^2$ or a BMI $\geq 35\,kg/m^2$ and significant comorbidities, in accordance with the National Institute of Health (NIH) consensus criteria for morbid obesity updated by the American Society for Metabolic and Bariatric Surgery (ASBS) in 2002.

C. Surgical Treatment: Benefit and Risk

The number of procedures continues to increase exponentially. This dramatic growth resulted from increased patient acceptance, which can be attributed in part to the introduction of laparoscopic surgery, as well as major progress achieved

in other vital areas, such as anesthesia, critical care, and parenteral nutrition. Performing major surgery such as Roux-en-Y gastric bypass by laparoscopy has offered patients significant advantages, such as less pain, fewer wound complications, and early recovery with relatively low complication rates.

There are a variety of surgical options, which can be classified into the following three categories: restrictive procedures, malabsorptive procedures, and combined restrictive/malabsorptive procedures.

Restrictive procedures limit the patient's ability to take in food, but do not directly interfere with the normal digestive process. In contrast, malabsorptive procedures promote weight loss by interrupting the digestive process, causing food to be poorly digested and absorbed. Some purely malabsorptive operations are no longer recommended due to their potential to cause nutritional deficiencies. Reduced energy intake is a common goal of all procedures. Bariatric procedures can be done either by the open or laparoscopic method. Each type of bariatric procedure has associated benefits, drawbacks, and risks. The possible benefit and risk of each procedure should be carefully considered to accommodate individual patient needs and preferences. Consultation with other specialists regarding surgical options and potential risks of surgery may be appropriate. The surgeon should be quite familiar with all past and present procedures as well.

Bariatric surgery, as any other surgical procedure, carries the potential for serious morbidity and mortality. Obese patients are considered at high risk for complications in part due to the presence of significant comorbidities. Any surgical procedure performed on this population is difficult, and is often associated with technical problems related to their unusual anatomy, resulting in peculiar situations when administering drugs, positioning, and more. General anesthesia also imposes a great risk for these patients—especially patients with obstructive sleep apnea or those with symptomatic gastroesophageal reflux and other predisposing conditions—due to the increased risk for both pulmonary gastric aspiration and difficult airways. Thus, severely obese patients necessitate a multidisciplinary evaluation prior to surgery.

Complications may be classified in relation to the operative procedure (intraoperative, early, and late postoperative). The most common causes of postoperative morality include unrecognized anastomotic leak, deep vein thrombosis (DVT) with secondary pulmonary embolism (PE), and cardiac and pulmonary complications.

Early postoperative complications (<30 days) include bleeding, anastomotic leak, infection secondary to leak, strictures, anastomotic obstruction, and small bowel obstruction. Late complications (≥ 30 days) include ulcers, stricture, obstruction, nutritional deficiency, internal/incisional hernia, redundant skin, failure of weight loss or regain, and psychological complications.

Psychological side effects include increased depression and disruption of social relationships, and may result from unrealistic expectation from surgery and exacerbation of preoperative physiological pathology. Thus, meticulous physiological screening and informative preoperative consultation are imperative for successful outcomes.

Relative and absolute contraindications for weight loss surgery include but are not limited to high risk for cardiac complications, poor myocardial reserve, significant chronic obstructive airways disease or respiratory dysfunction, noncompliance with medical treatment, significant psychological disorders, or significant eating disorders.

Several studies have attempted to identify risk factors associated with postoperative bariatric surgery mortality. These studies have generally found preoperative weight, male gender, age, and surgeon experience to predict increased mortality risk. Comorbidities, including diabetes mellitus and hypertension, have also been identified as preoperative predictors of increased postoperative risk. The risk–benefit ratio for the aforementioned group is complicated, as patients with these pathologies often have the greatest potential to benefit from weight loss.

As Centers for Medicare and Medicaid Services (CMS) consensus regarding Medicare coverage for new bariatric surgical interventions continues to evolve, further studies may be necessary to reach a conclusion about the risks and benefits of bariatric surgery in obese patients with BMIs between 28 and 35 kg/m^2.

The increase in adult morbid obesity is becoming a major cause of death and disability in the United States and coincides with an increase in adolescent morbid obesity and the development of adult-like comorbidities. Studies show that 50–77% of obese children and adolescents carry their obesity into adulthood, with an increase in risk to 80% if there is at least one obese parent. Currently available literature provides limited data regarding the pharmaceutical and surgical treatment of obesity in adolescent and pediatric patients. The existing data on adults may be inapplicable based on the unique needs and selection criteria of the adolescent patient population. Nevertheless, behavior and lifestyle interventions for adolescent obesity have limited success as in adults, and it is unreasonable to expect adolescents with severe obesity to become normal-weight adults. In addition, obese teens experience related comorbidities with high frequency and severity. Thus, recommendations regarding bariatric surgery for adolescents have been proposed by multidisciplinary teams and published. A recent report of a multicenter study of Roux-en-Y gastric bypass outcomes at 1 year in 30 morbidly obese adolescents demonstrated excellent weight loss and resolution of comorbidities, as in adults. The frequency of complications was similar to that seen in adults. The small sample, however, precluded clear delineation of the frequency of complications. Further studies are necessary to confirm this initial favorable experience in the adolescent population.

D. Global Credentialing Requirements

To meet the global credentialing requirements in bariatric surgery, the applicant should have credentials at an accredited facility to perform gastrointestinal and bariatric surgery.

Documentation that the surgeon is working within an integrated program for the care of the morbidly obese patient that provides ancillary services such as specialized nursing care, dietary instruction, counseling, support groups, exercise training, and psychological assistance is needed. Experience in diagnosing, managing, monitoring and treating short- and long-term complications is essential for successful outcomes. The trainee should participate in follow-up visits and should either be directly supervised by the bariatric surgeon of record or other health care professionals who are appropriately trained in perioperative management of bariatric patients and part of an integrated program. Although applicants

cannot guarantee patient compliance with follow-up recommendations, they should demonstrate evidence of adequate patient education regarding the importance of follow-up as well as adequate access to follow-up.

E. Experience in Bariatric Surgery Required to Train Applicants

For the purposes of this document, experienced bariatric surgeons serving as trainers for applicants should meet global credentialing requirements and have experience with at least 200 bariatric procedures in the appropriate category of procedure in which the applicant is seeking privileges prior to training the applicant.

F. Summary

Morbid obesity is a significant health concern. Medical management usually fails to achieve sustained weight loss, and medical management of obesity-related morbidities remains expensive and largely ineffective. Currently, bariatric surgical procedures are the most effective means to achieve significant, sustained weight loss, and thereby provide effective and durable treatment of obesity-associated morbidities. Experience and training in weight loss surgery, advanced surgical skills, and a commitment to long-term patient care are required for successful treatment of these patients.

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2. Overview of Bariatric Operations

Daniel E. Swartz and Edward L. Felix

A. Overview of Bariatric Surgery

Overweight, obesity, and morbid obesity, defined as body mass indices greater than or equal to 25, 30, and 40 kg/m^2, respectively, constitute a burgeoning global epidemic. Approximately 30% of Americans are obese, of whom over 5 million suffer from morbid obesity. For the latter cohort, bariatric surgery is the only effective means to achieve significant weight loss with improvement or resolution of comorbid diseases. The field of bariatric surgery began over 50 years ago and has grown steadily and, over the last decade, explosively, with over 100,000 procedures performed annually in the United States.

The purpose of this chapter is to present the reader with a framework for understanding the numerous described bariatric surgical procedures along with their historical development. The evolution of these operations has not been a linear process, as previously abandoned procedures have been modified and reintroduced. As newer technologies emerge, this framework will permit the reader to compare their function, advantages, and limits of use to existing procedures.

Bariatric operations are classified as purely malabsorptive, purely restrictive, or combined malabsorptive-restrictive (Fig. 2.1). An additional category, entitled "miscellaneous," contains the procedures that do not fit into the three standard classes. Note that no distinction between "laparoscopic" or "open" procedures is made, since these are merely approaches to perform a given procedure. The advantages of a laparoscopic approach (less pain, faster recovery, and fewer wound-related complications) are well established and require no further discussion here. The bariatric surgeon requires a thorough understanding of the recognized operations and, based on his or her ability, may perform them utilizing a laparoscope or a laparotomy.

B. Purely malabsorptive procedures

Purely malabsorptive procedures were initially popular in the 1960s and 1970s. Because of the risk of vitamin and protein deficiencies as well as diarrheal issues, these procedures are no longer performed as primary bariatric surgery in the United States.

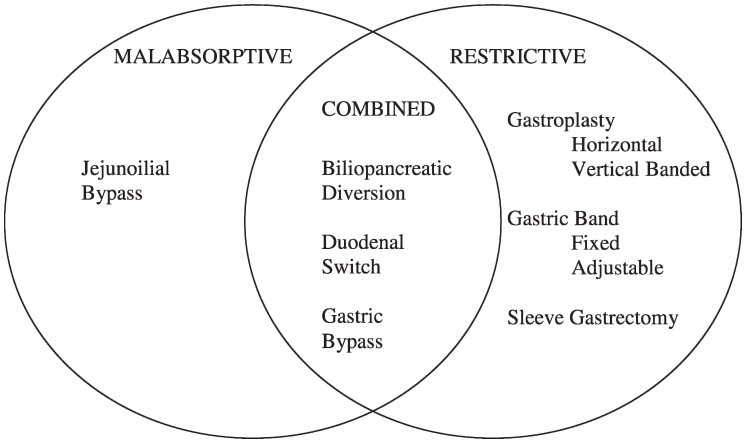

Figure 2.1. Venn diagram of the recognized bariatric operations.

1. Jejunoileal bypass

a. Development. The first surgical procedure performed on a large scale to treat obesity was the jejunoileal bypass (JIB). Early animal studies began at the University of Minnesota in 1953 and led to the first published clinical series by Kremen in 1954, who performed an end-to-end jejunoileostomy with drainage of the bypassed bowel into the colon. Severe complications and early failures led to the development of the classic 14-4 end-to-side jejunoileostomy.

b. Technique. The proximal jejunum is divided 14 inches (35.5 cm) from the ligament of Treitz and anastomosed to the terminal ileum 4 inches (10 cm) proximal to the ileocecal valve (Fig. 2.2).

c. Outcome. Approximately 25,000 patients have undergone a JIB. Patients achieved roughly 50% of excess body weight loss (EBWL). Malabsorptive side effects were significant, with severe electrolyte, nutrient and vitamin deficiencies; protein-energy malnutrition with alopecia and liver failure; renal oxalate urolithiasis from intestinal binding of dietary calcium by fatty acids; polyarthropathy by circulating immune complexes from bacterial proliferation and absorption in the bypassed limb; and socially impairing profuse and foul-smelling diarrhea from malabsorption of fat.

d. Current status. This operation has been abandoned since the early 1980s and most of the patients are thought to have been reversed or revised to other procedures. Our knowledge of intestinal malabsorption and, in particular, bypass enteritis has been significantly advanced from this procedure. Today, all bariatric procedures have intestinal limbs through which pass either food or bile so as to avoid the blind loop.

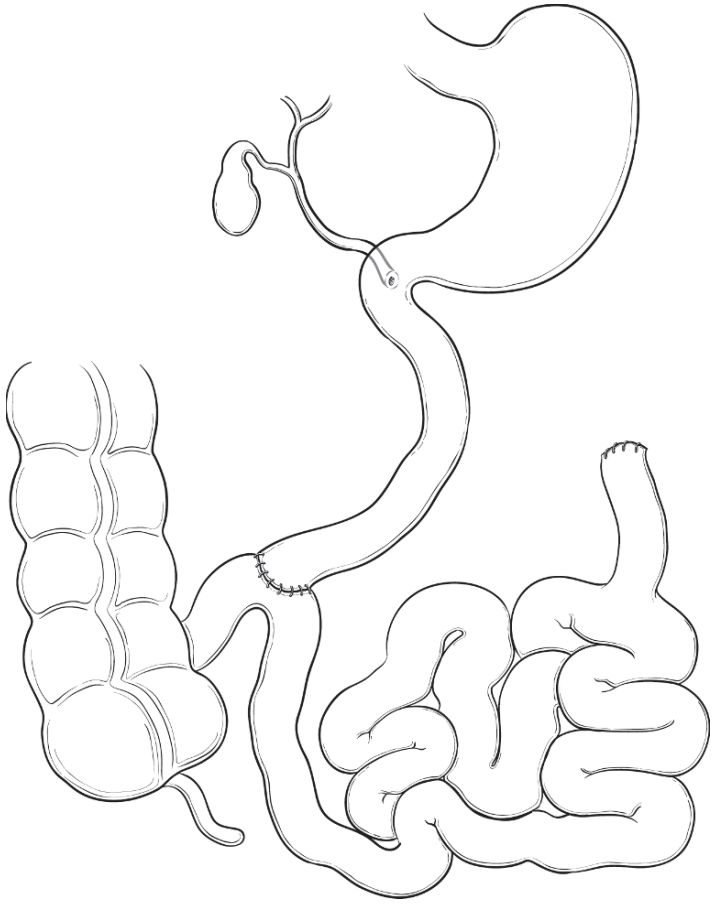

Figure 2.2. Jejunoileal bypass.

C. Combined Restrictive–Malabsorptive Procedures

1. Biliopancreatic diversion

a. Development. Scopinaro first described this procedure in 1979, which was designed to enhance the benefits of a malabsorptive procedure while minimizing the profile of side effects. Although the procedure involves a hemigastrectomy, leaving a 250- to 500-ml pouch, the restriction of this procedure is limited as the stomach stretches, and the long-term weight loss and comorbidity resolution is attributed to the

significant malabsorption. Distal gastrectomy is essential so as not to leave an intact antrum leading to uninhibited gastrin secretion with marginal ulcer formation, otherwise known as the "retained antrum syndrome." Adequate pouch size is similarly essential in order to counteract protein and macronutrient malabsorption by increasing intake. Scopinaro hypothesized that direct contact of undigested food with the ileal mucosa is thought to cause early satiety and, in the initial postoperative period, mild discomfort and vomiting; a state referred to as the "post-cibal syndrome."

b. Technique. Distal gastrectomy including the pylorus is performed, leaving a 250- to 500-ml proximal gastric pouch. The ileum is divided 250 cm proximal to the ileocecal valve and the distal stump is anastomosed to the gastric pouch. The proximal stump (biliopancreatic limb) is anastomosed to the distal ileum 50 cm from the ileocecal valve (Fig. 2.3).
c. Outcome. Two large series of patients with 15-year follow-up demonstrated approximately 71% EBWL regardless of preoperative BMI and comorbidity resolution that was equal or superior to results following gastric bypass. Morbidity occurs in 30%, including protein-energy malnutrition in 12.6%, ulcers in 8.3%, and a perioperative mortality of 1.3%.
d. Current status. The BPD achieves excellent weight loss and comorbidity resolution even in the superobese; however, mortality and long-term morbidity rates that exceed other bariatric procedures have tempered the enthusiasm for this procedure in North America. Most surgeons who advocated a preference for the BPD have migrated in favor of the duodenal switch (see the following).

2. Duodenal switch

a. Development. DeMeester first described this surgery in 1987 to treat bile reflux; however, Hess and Hess are credited with the first series of the duodenal switch (DS) to treat obesity in 1988.The DS has been lauded as a safer alternative to the BPD, with less malabsorption (and hence fewer malabsorptive sequelae), greater restriction, less marginal ulceration, less dumping, and lower perioperative mortality.
b. Technique. A sleeve gastrectomy is performed leaving a 200-ml gastric reservoir with the pylorus included in the alimentary limb. The duodenum is divided just distal to the pylorus and anastomosed to the ileum 250 cm proximal to the ileocecal valve. The biliopancreatic limb is then anastamosed to the ileum 100 cm from the ileocecal valve (Fig. 2.4).
c. Outcome. The 100-cm common channel of the DS has led to significantly fewer malabsorptive complications, such as fewer bowel movements per day and lower incidence of iron, calcium, and vitamin A deficiency when compared with BPD. Percent EWL is approximately 73% at 4 years, which is roughly equivalent to BPD.
d. Current status. Most surgeons who once advocated for BPD have migrated to the DS camp. Overall this represents a minority of North American bariatric surgeons. Since the weight loss in the superobese (BMI > 50) exceeds that found in Roux-en-Y gastric bypass, some

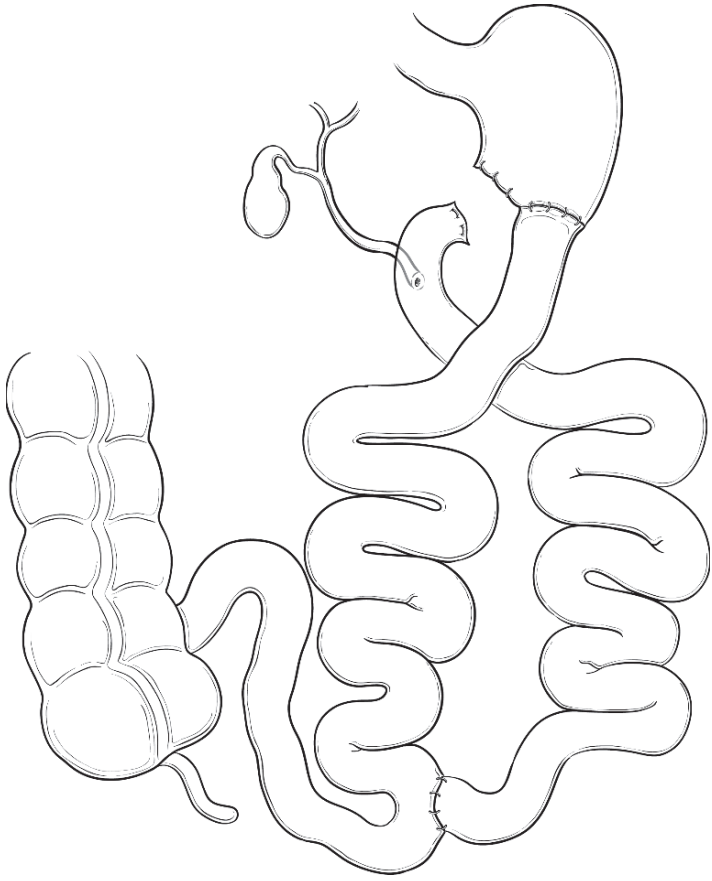

Figure 2.3. Biliopancreatic diversion.

surgeons have advocated for this technique in this group of patients either as a single- or two-staged procedure. Others have performed DS as a secondary procedure following other failed bariatric operations.

3. Gastric bypass

a. Development. Mason and Ito are credited with the first gastric bypass (GBP) for morbid obesity in 1966. Their operation included a horizontal gastric pouch with a 100- to 150-ml reservoir anastomosed to a loop of jejunum. This operation has evolved over the last four decades into what is considered the gold standard bariatric procedure to which all other procedures are compared. The fundamental modifications

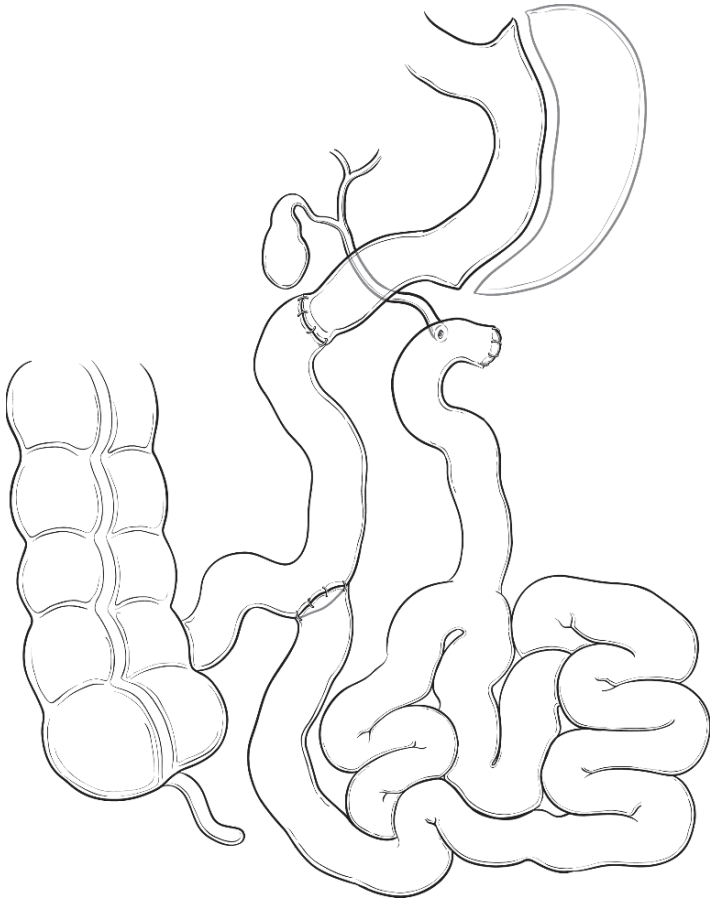

Figure 2.4. Duodenal switch.

included a Roux-en-Y drainage, vertical pouch based on the less-distensible lesser curvature, isolated gastric pouch (divided from the gastric remnant) with less than 30-ml volume and a 10- to 15-mm anastomosis. Brolin randomized superobese patients (BMI > 50) to 75 vs. 150 cm alimentary (Roux) limb lengths and found significantly improved excess weight loss at 2 years (50% vs. 64%, respectively).

b. Technique. The gastric pouch is created by creating a 15- to 30-ml pouch based on the lesser curve by stapling either "free-hand" or around a 32–34 French gastric lavage tube or Baker balloon. Care is taken to avoid injury to the left gastric artery, which supplies the pouch, and to exclude the fundus by not dividing the stomach to the left of the angle of His. The proximal jejunum is divided and the distal stump (alimentary

limb) is brought antecolic, retrocolic antegastric, or retrocolic retrogastric and anastomosed to the gastric pouch to create a 10- to 12-mm diameter stoma. The proximal stump of jejunum (biliopancreatic limb) is anastamosed to the alimentary limb either 75 to 100 cm distal to the gastrojejunostomy (BMI < 50) or 150 cm (BMI ≥ 50) (Fig. 2.5).

c. Outcome. Similar to the BPD and DS, the GBP results in dramatic metabolic and weight changes but with fewer malabsorptive sequelae. Excess body weight loss varies from 60% to 75% for 10 years and 50% at 14 years. Reported rates for comorbidity resolution are diabetes (80%), hypertension (70%), hypercholesterolemia (65%), gastroesophageal reflux disease (75%), and obstructive sleep apnea syndrome (75%). Thirty-day perioperative mortality is 0.5%. Potential vitamin and mineral deficiencies from malabsorption requiring lifelong monitoring include iron, calcium, folic acid, and vitamin B_{12}. The most severe complications include leaks (0–3%), internal herniation with or without strangulated bowel obstruction (2–5%), and perforated marginal ulcer (1%). Less severe complications include anastomotic stenosis (5–10%). Perioperative (30-day) mortality rates are 0.2% to 1% in most recent published series; however, larger regional surveys have reported up to 2%.

d. Current status. The GBP is the most commonly performed bariatric surgery, accounting for 85% of procedures in the United States and 65% worldwide. This is due to its excellent and durable results with low morbidity and mortality rates.

D. Purely Restrictive Procedures

1. Gastroplasty

a. Development. The gastroplasty procedures were an attempt to create a safer more physiologic procedure without intestinal anastomoses where leaks may occur. The stapled gastroplasties in which a partial partition was made by either horizontally or vertically placed staples to create a restrictive gastric pouch. However, the staple lines tended to break down with complete loss of restriction. Various modifications were described without success until Mason's series on vertical banded gastroplasties (VBGs) in 1982. This procedure utilized a restrictive pouch based on the lesser curvature with multiple staple lines and a stoma reinforced with prosthetic mesh.

b. Technique. A 32-French bougie is placed via the mouth and advanced along the lesser curve. An EEA stapler anvil is passed full thickness through the stomach from the lesser sac approximately 5 cm distal to the gastroesophageal junction. Several applications of a TA-90 or similar stapler are fired vertically to the left of the bougie across the angle of His. The stoma is then reinforced with a band of prosthetic material (Fig. 2.6).