Chapter 33

LAPAROSCOPIC BARIATRIC SURGERY

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INTRODUCTION

The laparoscopic approach to bariatric surgery emerged in the mid 1990s, following the success of laparoscopic cholecystectomy. However, the specificity and complexity of laparoscopic bariatric surgery has slowed its transition into common clinical practice. The laparoscopic approach requires appropriate, intensive training and experience in advanced laparoscopic techniques. Currently, increasing experience of surgeons allows us to review techniques and outcomes of laparoscopic bariatric procedures, mainly gastric bypass. In this chapter, we review the status of laparoscopic bariatric surgery, discuss its benefits and controversies, and present our experience and approach to laparoscopic gastric bypass. Some developmental issues are also discussed, with special consideration of new techniques. We emphasize the role of establishing a bariatric program based on laparoscopic surgery.

RATIONALE FOR SURGICAL MANAGEMENT OF OBESITY

Most surgeons and medical insurance providers today adhere to the guidelines for surgical management of obesity established at the 1991 National Institutes of Health Consensus Conference on Gastrointestinal Surgery for Severe Obesity.[1] The panel of experts reviewed the long-term data on safety and efficacy of medical and surgical weight loss and concluded that surgical therapy should be offered to morbidly obese patients who are unresponsive to nonsurgical therapy for weight loss. The rationale for surgery was based on a large volume of studies indicating that dietary weight reduction with or without behavioral modification or drug therapy had an unacceptably high incidence of weight regain in the morbidly obese within 2 years after maximal weight loss. Despite the introduction of new pharmacologic therapies since then, results of nonsurgical therapy for weight loss in the morbidly obese remain poor. According to the guidelines, patients are eligible for surgery if they have failed attempts at nonsurgical weight loss and have a body mass index (BMI) of 35 with comorbidity or a BMI of 40 with or without comorbidity. Based on well-documented long-term data, the panel approved the gastric bypass procedure.[1] Since this conference, a dramatic increase has occurred in the acceptance of bariatric surgery, with a corresponding increased understanding of alternative procedures and new approaches, particularly laparoscopic bariatric procedures.

HISTORICAL VIEW OF BARIATRIC SURGERY

Surgery for morbid obesity was developed in the late 1950s. Initially, intestinal bypass was performed to produce malabsorption, with the intent of producing weight loss through the inability to absorb high-calorie foods. The initial jejunocolic bypasses were followed by electrolyte imbalance, intractable diarrhea, and liver failure, unless they were reversed. This led to development of the jejunoileal bypasses (JIB) in which a critical length of intestine in-continuity was ascertained. A shorter length of intestine was associated with electrolyte imbalance. Also, liver failure was not infrequent, especially in protein-deficient patients. Other problems like oxalate renal stones and blind-loop syndrome also occurred in these patients.[2]

In an attempt to restrict food intake, horizontal gastroplasty was developed. Frequently seen failures were due to proximal fundal pouch dilatation, outlet dilatation, or staple-line breakdown. In 1980, E. Mason began performing the vertical banded gastroplasty (VBG). It consists of a stapled vertical gastric channel along the lesser curvature, extending to the angle of His. Sufficient weight loss has been generally achieved; however, breakdown of the partition have produced concern.[3] Other complications of gastroplasty include Wernicke's encephalopathy and vitamin and iron deficiency.

In late 1960, the gastric bypass procedure was introduced. Weight loss is achieved through production of a small proximal gastric pouch with emptying to a loop gastrojejunostomy. Later, the transverse pouch was changed to a vertical lesser curvature pouch. Gastric pouch problems like marginal ulcers and staple line disruption led to the creation of a transected gastric pouch. Introducing a Roux-loop modification prevented bile gastritis and decreased tension on the bowel loop. Vitamins (particularly B12, folic acid, and A), iron, calcium, and zinc must be replaced and monitored after gastric bypass.[4]

In late 1970, Scopinaro[5] developed the biliopancreatic diversion (BPD). In this operation, the small bowel is divided 250 cm proximal to the ileocecal valve. The proximal segment of the bowel is anastomosed to the gastric pouch. Protein malnutrition has been a sequela in some patients. The BPD produces the most effective and sustained loss of excess weight of any of bariatric procedures thus far. Further modifications of BPD include a duodenal switch, where the pylorus is left intact. This prevents marginal ulceration and improves gastric emptying.

In late 1970, gastric banding was introduced. Various band materials were used to create a small upper gastric pouch. This is the least invasive bariatric procedure, though complications like band migration and slippage occur. Indeed, although all the bariatric operations are being performed laparoscopically, gastric banding lends itself more than other procedures do to the laparoscopic approach. Inflatable bands can be adjusted according to actual outcome and side effects. This procedure is reversible. Results, satisfactory in most European reports, are not yet confirmed in American studies.

BENEFITS OF LAPAROSCOPIC BARIATRIC SURGERY

With over 50 years of extensive experience, classic open surgery for weight loss has became safer; however 2 complications remain: cardiopulmonary problems and wound problems. Another disadvantage of the open approach is the prolonged recovery time. Recovery time and morbidity have been significantly reduced with the introduction of the laparoscopic approach. Extended abdominal incisions in morbidly obese patients bring the additional jeopardy of serious complications in patients who are already in a high-risk group. The major advantage of the laparoscopic approach to bariatric surgery is the significant reduction in perioperative morbidity, which is even more significant than that seen in nonobese patients.

Recent studies have shown clear benefits of the minimally invasive approach for organ-system impairment. In particular, hypermetabolic stress characterized by increased energy expenditure, myocardial oxygen demand, and pulmonary and renal workload is usually initiated by extensive tissue injury as seen in open surgery.[6] This stress response following open versus the laparoscopic approach has been well demonstrated by measuring the acute-phase reactants, such as catecholamines, cortisol, glucose, cytokines, and others.[7] Surgical injury also adversely effects postoperative immune function, in particular, cell-mediated immunity.[8] The laparoscopic approach may prevent this immune impairment through minimizing perioperative trauma. The cardiac complication rate is reduced following the laparoscopic approach due to reduced myocardial oxygen demand.[9] In addition, preserved pulmonary function is a well-demonstrated benefit of laparoscopic bariatric surgery. Preservation of total lung capacity, oxygen saturation resulting in fewer pulmonary complications, may be particularly important for morbidly obese patients.[10]

Laparoscopic access has significantly reduced postoperative wound complications, including incisional hernias and dehiscences.[9] Similarly, postoperative adhesion formation and related complications are relatively infrequently seen following laparoscopic surgery.[11] Our recent data support the hypothesis that laparoscopic bariatric surgery is equally effective in reducing weight in high-risk patients, and these patients benefit from improvement in their ASA status. High-risk patients experience a greater reduction in comorbidities; however, they may have higher rates of perioperative and postoperative complications.[12]

LAPAROSCOPIC VERSUS OPEN GASTRIC BYPASS

Both open Roux-en-Y gastric bypass (RYGB) and laparoscopic Roux-en-Y gastric bypass (LRYGB) have proven to be equally effective methods for weight control for the morbidly obese patient. Mortality rates are very similar and rarely exceed 1%. Wound care problems and ventral hernias are more common in the open approach, whereas anastomotic stenoses are more common in operated on patients laparoscopically. In some series,[13] anastomotic leaks and small bowel obstruction rates were very similar in both groups.

Nguyen et al[14] compared outcomes, quality of life, and costs of laparoscopic and open gastric bypass. Operative time was longer for laparoscopic gastric bypass, with less blood loss. Patients after LRYGB have a shorter hospital stay. The rate of postoperative anastomotic leak was similar between groups in this series. Wound-related complications such as infection and incisional hernia were more common after open gastric bypass; late anastomotic stricture was less frequent after the open procedure. Time to the return to daily living activities and work was shorter after laparoscopic gastric bypass than after open. Weight loss at 1 year was similar between groups. In a short follow-up, patients who underwent laparoscopic gastric bypass have better physical conditioning, social functioning, general health, and less body pain. Operative costs were higher for laparoscopic gastric bypass, but hospital costs were lower.[14]

Internal hernias are more common following laparoscopic RYGB than after open RYGB. Early intervention is crucial; most repairs can be performed.

One of the important disadvantages of laparoscopic bariatric surgery is intraoperative heat loss. Heat loss occurs not only from the exposed skin surfaces but mainly from the exposure of the abdominal cavity and viscera to large volumes of cool, dry CO_2 insufflation gas.[15] Many attempts have been made to overcome this problem; these include heated coils to warm and humidify the gas as it is delivered through the insufflation system.[16] Laparoscopic bariatric surgeons and anesthesiologists should take precautions to minimize all hypothermia-inducing risk factors.

Several cases of pneumoperitoneum-related oliguria and renal failure have been reported. One of the postulated mechanisms includes vasoconstrictive effects of absorbed CO_2 Laparoscopic procedures can lead to visceral ischemia and ultimately to permanent end-organ damage and increased gut-mucosal permeability to intestinal bacteria. Because significant numbers of obese patients with underlying arteriosclerosis or renal diseases are referred for bariatric surgery, the potential risk for visceral ischemia remains a major problem.[6]

Laparoscopic surgery may also lead to increased risk of deep venous thrombosis. One of the mechanisms includes a reduction of flow in the common femoral veins after establishment of pneumoperitoneum. Impaired venous return, enhanced by the reverse The Trendelenburg position during a laparoscopic bariatric procedure may increase intraoperative venous stasis.[17]

EQUIPMENT AND INSTRUMENTATION FOR LAPAROSCOPIC GASTRIC BYPASS

Visualization

For most bariatric laparoscopic procedures, a 5-mm, 30-degree scope assures adequate visualization in a frequently limited abdominal cavity space. A long 45-cm laparoscope is sometimes helpful in superobese patients. A stainless steel thermos filled with hot sterile water helps cleaning the lens and prevents it from fogging. A miniature, 3-CCD camera provides a high-resolution image. We found the Hermes voice activated unit very useful, because it controls many parameters of the camera without involving surgeons' hands. The video monitor is the same as that for most laparoscopic procedures; however, having more then 1 monitor helps a surgeon work more comfortably.

An automated, electronically controlled insufflator allows maintenance of intraabdominal pressure at 15 mm Hg or higher, when better exposure is needed. The use of 2 insufflators, set for a high gas flow rate overcomes frequently seen gas leakage in bariatric procedures. The 150-mm long, 2-mm diameter Veress needle is used for establishing a pneumoperitoneum. The open technique might be very difficult in obese patients. Disposable trocars and ports of 5-mm, 11-mm, and 12-mm are commonly used. Extra-long trocars are rarely required. Trocar sites greater then 10 mm should be closed to prevent incisional hernias. Heavy liver rectractors are necessary for retraction of an usually enlarged liver.

Laparoscopic Instruments

A large variety of laparoscopic instruments is in use. We prefer "in-line," ratcheted instruments with finger-controlled rotation of the shaft. Many instruments are available in extra-long lengths. An atraumatic grasper is necessary for safe bowel manipulation. A crocodile grasper with long contoured jaws is useful for holding the stomach and the omentum. The laparoscopic Babcock and fenestrated jaws instrument is used for atraumatic bowel grasping. The 10-mm endoscopic bowel clamp is used for clamping the small bowel before intraoperative endoscopy. Endoscopic scissors and clip appliers are the same as those for other advanced laparoscopic procedures.

An endoscopic linear stapler is an essential instrument for bariatric surgery. Cartridges of various lengths (30 mm, 45 mm, 60 mm) containing staples of various heights (2.0 mm, 2.5 mm, 3.5 mm, 4.8 mm) are used for various tissue thicknesses. Some surgeons recommend an endoscopic 21 mm or 25 mm EEA stapler for creating a gastrojejunal anastomosis. It is also useful in vertical banded gastroplasty procedures. Various methods of anvil insertion into the gastric pouch have been introduced, including the transgastric or transoral approach. A disposable suction-irrigation instrument is one of the must-have devices.

Endoscopic suturing technique using laparoscopic needle drivers requires experience but is essential for most of the bariatric procedures. Endoscopic suturing might be facilitated with the Endostich device, which can be loaded with a variety of suturing materials.

Having an ultrasonic coagulator for bariatric procedures is generally recommended, although a standard unipolar or bipolar electrocautery device must be available in the operating room. Ultrasonic energy sources provide excellent hemostasis avoiding the risk of electrical injury associated with standard electrocautery; however, it must be remembered that heat is generated from the ultrasonic jaws. Ultrasonic energy may be used for lesser and greater curves of stomach dissection as well as for creating enterotomies.

Operating Table

The operating table remains the most important component of the bariatric program operating room. A table that can bear weights up to 400 kg is essential. The operating table must assure maximum flexibility, with tilt and rotation required in laparoscopy to obtain good exposure. Table accessories like footboards, straps and padding secure the patients to the bed and prevent injuries.

Anesthesia for Laparoscopic Bariatric Surgery

Anesthesiologists who will manage bariatric patients undergoing laparoscopic operations must be familiar with pulmonary and hemodynamic changes that occur upon establishing and maintaining prolonged pneumoperitoneum. It is recommended to have more than one experienced anesthesiology staff available, or he or she should be assisted by qualified, similarly experienced, anesthesia nursing personnel.

It is important for anesthesiologists to be familiar with anatomic and physiologic implications and pharmacologic changes associated with obesity, so that they can offer optimal preoperative treatment. Preoperative assessment of the cardiovascular system must be very careful in all obese patients and has to be oriented to evaluate the cardiac risk.

One of the main concerns in anesthesia in morbidly obese patients is the difficulty that may be encountered in maintaining an airway. In lung function tests, we can often see decreases in expiratory reserve volume (ERV), inspiratory capacity, vital capacity, and functional residual capacity (FRC). Drug pharmacokinetics differs in morbidly obese patients. Changes in volume of distribution include a smaller than normal fraction of total body water, greater adipose tissue content, altered protein binding and increased blood volume. Possible changes in renal and hepatic function have to be taken into consideration when administrating drugs.

Although similar anesthetic agents are used for both open and laparoscopic bariatric surgery, ventilation management for laparoscopic surgery is different, and the increased intraabdominal pressure and possible absorption while pneumoperitoneum is maintained should be taken into account. Several serious systemic consequences may arise after pneumoperitoneum and increased gas absorption. These include hypercapnia and respiratory acidosis. Increased intraperitoneal pressure may lead to elevation of the diaphragm, thus significant restriction of lung expansion, which is already reduced in morbidly obese patients. Experienced anesthesiologists should be able to appropriately adjust ventilation, minimizing the effects of airway pressure.

Abdominal Access

In laparoscopic gastric bypass, exposure is achieved by insufflation of the peritoneal cavity with CO_2 to create a pneumoperitoneum. CO_2 is the preferred gas for laparoscopy because it is inexpensive, readily available, and highly soluble, allowing relatively large quantities to be safely absorbed and excreted by the lungs. It is also noncombustible, permitting the use of lasers and electrocautery. The intraabdominal pressure is usually set at 15 mm Hg and can be increased when needed for better visualization. Using 2 insulators is recommended for laparoscopic bariatric procedures to provide added compensation for gas leakage.

Laparoscopic gastric bypass usually requires 5 to 6 abdominal access trocars. Special attention should be paid to the liver retraction system, as this organ may significantly obstruct the vision field and free access to the stomach in obese patients. Attention should be paid to the left lobe of the liver, which is usually elevated using retractors. Some surgeons suggest a 2-stage procedure to reduce the volume of the liver, thus allowing better access to the upper part of the gastrointestinal tract. This is especially true when dealing with a large, fatty infiltrated liver.

The great advantage of the laparoscopic bariatric procedure is that creation of a large working space reduces the need for extensive traction and manipulation of the viscera. Although it requires a high level of skill and good special orientation as well as proper instruments, laparoscopic access may reduce the risk of unnecessary manipulation in the abdominal cavity.

PATIENT SELECTION

Proper selection of candidates for laparoscopic gastric bypass depends on both the surgeon and the patient. The surgeon's experience with laparoscopic bariatric surgery using advanced laparoscopic techniques is of crucial importance. Currently available training programs include fellowships and courses, and recently, many centers have incorporated laparoscopic surgery into their surgical residency program. A surgeon must be exposed to a variety of problems during his training. The so-called "learning curve" is especially important in laparoscopic gastric bypass. Surgeons with minimal experience should select patients with lower BMI (<45), patients with gynoid body habitus, and without a history of abdominal surgery. Finally, a surgeon's individual predisposition guides that surgeon into different categories of professional expertise.

Not all patients are suitable for laparoscopic gastric bypass. It has been commonly concluded that patients with compromised cardiac, renal, respiratory, or hepatic function are not good candidates for laparoscopic bariatric surgery. The potential jeopardy for these patients lies in the influence of prolonged pneumoperitoneum and exposure to increased intraabdominal pressure on various systems and organs. Whether cirrhotic patients and those with renal failure can be safely operated on is still an issue of debate.

EVOLUTION OF THE LAPAROSCOPIC GASTRIC BYPASS TECHNIQUE

The gastric bypass operation has evolved with many variations since Mason[19] first described it in 1969. Griffen,[20] who first introduced loop gastric bypass in 1977, established the basis for gastric bypass surgery. Due to many complications, such as alkaline gastritis and esophagitis, this operation was abandoned. Wittgrove et al[21] first described laparoscopic Roux-en-Y gastric bypass was in 1996. Their technique involves creation of a 15 mL to 30 mL isolated gastric pouch; a 21-mm stapled circular anastomosis; a 75-cm retrocolic, retrogastric Roux-limb, and stapled side-to-side jejunojejunostomy. They used a transoral pull-wire technique to advance the end-to-end anastomosis (EEA) anvil. Most surgeons currently follow this technique; however, some prefer to extend the Roux-limb length to 150 cm or 250 cm for superobese patients. The antecolic, antegastric Roux-limb technique avoids challenging creation of a retrocolic tunnel, though it has been suggested that it may create tension and increase risk of stricture. Champion et al[22] described alternative gastrojejunal anastomosis using an end-side connection with the Endo-GIA. Higa et al[23] described and successfully performed a hand-sewn gastrojejunostomy. Most surgeons agree that the mesenteric defect and Petersen's defect (in the antecolic technique) should be routinely closed. Internal hernia and bowel obstruction have been reported, prompting surgeons to begin closing all mesenteric defects.[24-26]

A long-debated issue concerns gastrojejunostomy in RYGB. Before the laparoscopic era, it was commonly performed in a hand-sewn fashion. In general, 2 schools dominated the laparoscopic technique. One described by Wittgrove[27] uses a circular stapler in performing the gastrojejunostomy. On the other hand, Champion[22] reported good results with a linear stapler technique. Some controversies may arise when the transoral anvil placement technique is considered. In their extensive experience with the transoral technique, Wittgrove et al[27] did not report esophageal injuries in the first 1400 patients who underwent surgery with the percutaneous pull-wire technique for the 21-mm circular stapler anvil placement.

Many reports describe passing the EEA anvil transorally using an esophagogastroscope and a pull-wire technique.

Apart from esophageal injury that may occur when applying the transoral anvil placement technique, it may also become lodged at the cricopharyngeus muscle. Dislodgment can be problematic and time-consuming. Another alternative for placing the EEA anvil is the transgastric technique in which the anvil is passed through a gastrotomy. This technique alleviates the need for endoscopy, thereby saving time and resources and eliminates the potential for esophageal injury.[28]

Gastrojejunal anastomosis is a potential place for leaks and much effort has been made to minimize such risk. Higa et al[25] report no anastomotic leaks in their large series of the hand-sewn gastrojejunostomies. Only a surgeon with advanced laparoscopic skills and experience can safely perform the laparoscopic Roux-en-Y gastric bypass with a totally hand-sewn gastrojejunostomy. Higa et al[25] also admit that closure of all potential hernia sites with nonabsorbable sutures is essential.

Despite controversies, many surgeons agree that selection of a particular technique mainly depends on the individual surgeon's preferences, his familiarity, and expertise. None of the techniques are considered the standard in laparoscopic bariatric surgery. Whichever technique is chosen, it is not completely free of possible complications.

Anastomosis leakage remains the most important and relatively frequent complication. It is considered prudent to check the gastrojejunostomy for leaks, before completing the procedure. Several methods have been described. Many authors place methylene blue in the gastric pouch and observe any coloring around the anastomosis. We use an endoscope to flow air by the anastomosis while it is under irrigation for watching bubbles. This technique allows immediate evaluation of the anastomosis, especially in regards to possible technical errors or bleeding.

The laparoscopic jejunojejunostomy seems to be less controversial. Most authors recommend a linear stapler technique. Recently, Gagner et al[29] reported on a technique that uses a purse-string device for the jejunojejunostomy anastomosis. Differences arise when the closure of the remaining intestinal defect is considered. Some authors prefer the hand-sewn technique, while others use additional linear stapling for closing the defect. Currently, most authors recommend closing a mesenteric defect, such as postoperative internal hernia, which may be a serious consequence of the bowel migrating into the mesenteric defect.

The retrocolic, retrogastric technique has been commonly used in open gastric bypass. Initially, this technique was transferred to laparoscopic surgery. Now many surgeons prefer the antecolic technique. The main criticism concerns possible tension and bowel obstruction. As surgeons gain more experience, these problems are not seen very often.

Surgical management of the super-super obese patient (BMI>60 kg/m^2) has been a challenging problem associated with higher morbidity, mortality, and long-term weight loss failure. Currently, limited experience exists with a 2-stage biliopancreatic diversion and duodenal switch in the super-super obese patient. The procedure consists of dissection along the greater curvature of the stomach starting about 8 cm proximal to the pylorus. Gastrectomy is performed with successive firing of Endo-GIA linear cutting staplers from the prepyloric region towards the gastroesophageal junction. Some surgeons use buttressing materials to prevent stapler line leakage and bleeding. Others recommend using a 60-F bougie for calibration of the sleeve. A short-term follow-up showed the effectiveness of laparoscopic sleeve gastrectomy with second-stage Roux-en-Y gastric bypass. BMI significantly decreased at 6-month follow-up, decreasing the operative risk represented by the ASA class with acceptable complication rates. Serious comorbidites, including type II diabetes mellitus, sleep apnea, hypertension, and asthma resolve or improve in the majority of patients. The 2-stage approach is a reasonable alternative for surgical treatment of the high-risk super-super obese patient.[30-32]

TECHNIQUE OF LAPAROSCOPIC ROUX-EN-Y GASTRIC BYPASS

Our approach to laparoscopic Roux-en-Y gastric bypass involves construction of an isolated small gastric pouch (15 mL to 30 mL) with retrocolic, retrogastric Roux-limb (75 cm) and stapled jejunojejunostomy. To achieve greater weigh loss in superobese patients, we extend the Roux limb to 150 cm to 250 cm.

The patient is placed in a supine position for the first part of the operation. A steep reverse Trendelenburg position with the surgeon on the right and the assistant on the left is used for creation of gastric bypass and gastrojejunostomy. This allows a lot of the abdominal content to fall down towards the pelvis. Pneumoperitoneum is created with the Veress needle technique (US Surgical, Norwalk, CT). The left lateral segment of the liver is elevated using a 5-mm liver retractor (Snowden Pencer, Tucker, GA) inserted through the right subcostal port, allowing exposure of the esophagus and stomach. The omentum is gently paddled up towards the upper abdomen allowing better access to the small bowel and the ligament of Treitz. The liver with macroscopic signs of fatty infiltration is biopsied.

A gastric pouch is created by formation of a window in the lesser omentum near the gastric wall at the lesser curvature. The Endo-GIA stapler (US Surgical, Norwalk, CT), 60-mm long with 4.8-mm staples is introduced and deployed to staple and cut the gastric pouch.

Then, once the greater omentum and transverse colon are passed to the upper abdomen and the ligament of Treitz is identified, the Roux limb is measured using Snowdon Pencer clamps. The small bowel is then configured in a C shape, which facilitates placing staplers. The jejunum is divided 30 cm to 50 cm from the ligament of Treitz using an Endo-GIA stapler (US Surgical, Norwalk, CT), 45-mm long and 2.5-mm staples. Two additional applications of the Endo-GIA staplers with vascular load (45-mm long, 2.0-mm staples) are used for transection of the mesentery of the jejunum. This allows a sufficient length of mesentery to bring up the Roux limb to the gastric pouch. We position both cut ends of the bowel next to each other with the Roux limb placed distally and the bilio-pancreatic limb placed proximately. We mark the end of the Roux-limb sawing a 6-cm length of Penrose drain. It also helps handling the limb over the colon. The drain is sutured using the Endo-stitch to pass the stitch to the corner of the bowel.

Then, the Roux-limb is measured distally. For patients with a BMI<50, we measure a 75-cm Roux limb, whereas superobese patients with BMI>50 require a 150-cm Roux limb. All bowel measurements are performed using a tip of the Endo-grasper instrument and a 10-cm landmark. Using this measuring method, we mark off in increments of 10cm. Special care must be taken when grasping the bowel, which should not be touched at the mesentery border. A stay suture helps approximating the bilio-pancreatic limb to the Roux limb. Enterotomy is created in both ends of the bowel using a Harmonic scalpel. Then, a stapled side-to-side anastomosis is created using the Endo-GIA stapler, 60-mm long, 3.5-mm staples. Applying the same size of stapler closes the remaining enterotomy openings. This step is facilitated by 3-point fixation with stay suture in the middle of the enterotomy and holding 2 corners with graspers. Some fine-tuning is usually required to keep the closure from being too tight and thus obstructed. Another cause of obstruction at this site is bowel kinking, which can be prevented by using additional protective stitches. Mesenteric defects are routinely closed to prevent internal hernia formation. We use a running suture (2.0 Surgidac, US Surgical, Norwalk, CT). The Roux limb is then passed toward the stomach. Creating a tunnel in the omentum with the ultrasound dissection may reduce tension to the limb.

Next, we change the positioning of the patient to a transverse Trendelenburg, which provides better exposure of the upper abdomen. Gastric pouch creation starts on the lesser curvature. The 60-cm white stapler is used across the mesentery of the stomach. The blue load (45-mm, 3.5-mm stapler) is used next on the stomach at 1 cm to 2 cm below the gastroesophageal junction. This allows creation of small, approximately 15 mL, gastric pouch. Further staplers are applied towards the angle of His. The last staple is placed through a tunnel created with a right-angled instrument towards the angle of His.

Such a gastric pouch is freed from the left crus to provide more mobility. Then, the patient is repositioned supine. After the surgeon checks for tension-free bowel passage, the Roux limb is sutured to the posterior wall of the gastric pouch with running sutures (2-0 Surgidac, US Surgical, Norwalk, CT). Enterotomies are made with the ultrasonic dissector in the pouch and in the bowel. Then we insert the blue load stapler (60-mm long, 3.5-mm staples) for about 1.5 cm into the pouch and jejunum. The gastrojejunostomy is created by using a 2-layer closure and applying the Endo-GIA stapler. The remaining enterotomy is closed using Endo-stitch absorbable sutures. A final anterior layer of interrupted or running sutures (2-0 Surgidac, US Surgical, Norwalk, CT) is placed within a sero-muscular outer layer to complete and secure the anastomosis. Corners of such created anastomosis are secured with additional sutures. We routinely use intraoperative endoscopy for testing leakages after insufflating and submerging it in irrigation fluid. In addition, the endoscope acts as 30-F size stent so that the lumen is not compromised as we tighten the suture. Putting a clamp across the bowel tests the anastomosis. A drain is placed posterior to the anastomosis, and the omentum is placed across the anastomosis. Finally, we close all port sites 12 mm to prevent hernia formation.

POSTOPERATIVE MANAGEMENT

After awakening from anesthesia, the patient is closely monitored and transported to the recovery room for approximately 2 hours. The patient spends the next 2 days to 3 days in the bariatric ward. The anastomosis is evaluated with a gastrointestinal radiological barium swallow study the first day after surgery. If no abnormalities are found, a liquid diet is started with a gradual increase to a soft diet over a maximum of 1 week.

Most of the patients are discharged within 2 days to 3 days after surgery, and then they are seen in the bariatric clinic 1 week, 1, 3, 6, 9, 12, 18 months, and then annually after surgery. During postoperative visits, the patients are evaluated for progress in their weight loss and counseling about their diet and exercise. All gastric bypass patients receive supplemental calcium, iron, vitamin B12, and multivitamins. Their nutritional status is evaluated twice a year with a complete laboratory blood work analysis. Percutaneous Gastrografin studies require the insertion of a gastrostomy tube into the distal stomach. Recently, virtual CT gastroscopy (VG) was used for this purpose, depicting an intraluminal view of the stomach and duodenum.[33]

THE LEARNING CURVE

Laparoscopic bariatric surgery is the most complex of all laparoscopic procedures and requires a long learning curve. On a 10-point scale of difficultly, both laparoscopic gastric bypass and biliopancreatic diversion with duodenal switch are at the highest positions. The difficulties are associated with the need for extensive preparation, many transactions, stapling, and suturing tasks. Creation of 2 anastomoses places this surgical technique among the most difficult. A surgeon should gain adequate experience in open bariatric surgery. Many situations like intraoperative and late complications and the need for conversion require a thorough familiarity with the open technique. For obvious reasons, a high degree of knowledge and experience in preoperative and postoperative management is essential.

The most important requirement however is expertise in advanced laparoscopic technique. Many ways exist to achieve this goal. Many laparoscopic bariatric courses, hands-on practice, animal and simulation models, observership, and perceptorship are well developed and offered by many institutions. The most important however is direct training under the supervision of an experienced bariatric surgeon. Currently, a number of fellowships and mini-fellowships are offered throughout the country.

Our experience clearly shows a long learning curve for the first 150 operations. Compared with other laparoscopic procedures, LRYGB requires a longer time to minimize morbidity related to the learning curve. Operative time and technically related complications decreased with operative experience although heavier patients and higher-risk patients were more predominant in the latter part of our experience.

OUTCOMES AFTER LAPAROSCOPIC GASTRIC BYPASS

Roux-en-Y gastric bypass has been shown to produce significant weight loss in patients with clinically severe obesity: most studies report a weight loss of 60% to 70% of excess body weight.[35,36] Many surgeons contend that RYGBP is the bariatric procedure of choice for most patients with clinically severe obesity.

As opposed to the vertical banded gastroplasty and banding series, gastric bypass series have significantly more patients with mean BMIs in the high 40s or low 50s. Some series have patients with BMI>70 kg/m^2. Operating time generally ranges from 2 hours to 4 hours and appears to increase with increasing BMI but decreases with experience. Conversion rates are less than 5%. Although there appears to be significant variability in methods for detecting and reporting complications, both early and late complication rates (3.3% to 15% and 2.2% to 27%, respectively) are reasonably low. The mean hospital stay (including complications) is typically 2 days to 3 days. Most series have a mean follow-up of less than 2 years but consistently demonstrate a favorable estimated weight loss of 65% to 80%. Most authors report that the majority of comorbidities, such as hypertension, sleep apnea, or type II diabetes were either resolved or improved with significant weight loss.

Specific complications after LRYGBP include leaks and bowel obstructions. The larger series report a slightly higher leakage rate, particularly at the gastrojejunal anastomosis in their early experience (first 30 cases) that appears to decrease with additional experience. Bowel obstruction is usually related to internal hernias resulting from unclosed mesenteric defects. In a series of more than 1,000 cases, Higa et al[25] report the most common complications as being stenosis at the gastrojejunostomy (4.9%), intimal hernia (2.5%), marginal ulcer (1.4%), and staple line leaks (1%). The overall mortality in that series was 0.5%.

The early results of LRYGBP compare favorably with results of most series of open RYGBP. Absence or reduced rates of cardiopulmonary, and particularly wound-related, complications are the most notable. Nguyen et al[37] showed that LRYGBP patients had significantly less pulmonary impairment and postoperative pain than did open-bypass patients. Fewer patients developed hypoxemia requiring supplemental oxygen after LRYGBP than after open surgery. Also, fewer patients who underwent laparoscopic procedures developed segmental atelectasis on the first postoperative day.[37] Significant wound-related complications are very rare following laparoscopic gastric bypass.

The recovery after LRYGBP appears to take half as long as recovery after the open approach. The mortality rate (0% to 1.5%) after LRYGBP is comparable to that of the open approach. It has not been demonstrated whether the laparoscopic approach has a positive effect on perioperative mortality in high-risk patients.

Our current size limit, a BMI of about 70 kg/m^2, is primarily set because of inadequate instrument length. Finally, the laparoscopic approach may be exceedingly difficult in patients with enlarged livers because of inadequate exposure of the esophagogastric junction. Additional ports to retract the enlarged liver may be necessary. Recently, sleeve gastrectomy resection has been proposed to overcome these problems.

MANAGEMENT OF COMPLICATIONS

Surgeon involved in management of complications following LRYGBP in obese patients should have a very low threshold of suspicion, and diagnosis of complications needs to be done as early as possible. Clinical manifestations, especially those of intraabdominal septic complications, differ from standard clinical manifestations in the nonobese patient.

Bariatric surgeons should be familiar with a strategy to manage complications and identify them before they are overtly manifest in the postoperative period.

Venous Thromboembolism

Morbidly obese patients are at higher risk for thromboembolism. Laparoscopic surgery, despite its advantages, may take longer during the surgeon's early experience, compared with time required to perform the open approach, bringing additional jeopardy for patients. Gastric bypass carries a mortality rate of between 0.5% to 1%, with pulmonary embolism (PE) being the most common cause of death. Prophylactic methods include low molecular weight heparins (LMWH) in combination with mechanical calf compression.[38] The incidence of fatal pulmonary embolism ranges from 0.2% to 0.64%[24,39,40] accounting for between 30% to 50% of all deaths after this operation.[41,42] For particularly high-risk patients for venous thromboembolism (lower limb venous stasis, BMI>55, history of previous venous thromboembolism, and obesity hypoventilation syndrome) prophylactic placement of a vena caval filter should be considered.[43-45]

Confirming the clinical diagnosis may be difficult because most CT suites are unable to accommodate patients over 300 lb, and it may not be possible to obtain this investigation or a ventilation-perfusion scan. In this situation, it is safer to empirically start full anticoagulation, accepting an 11% risk of major hemorrhage (of which 3% will be fatal) for 5-days of intravenous heparin compared with an overall 6% risk of death and 2% risk of serious permanent disability associated with pulmonary embolism.[46] Unmonitored therapy with low molecular weight heparin provides an equivalent practical alternative.[47]

Intestinal Leaks

In between 2% to 7% of Roux-en-Y gastric bypass procedures, intestinal leaks occur.[24,25,48] Several strategies have been proposed to prevent leaks, including avoiding devascularizing the gastric pouch, avoiding excess tension on gastrojejunal anastomoses, oversewing the staple line, identifying and repairing leaks intraoperatively, and placement of buttressing materials on the staple line.

Not all leaks result in overt peritonitis and sepsis. The majority have less obvious manifestations. Excessive abdominal pain, shoulder tip pain, hiccups, and a sense of impending doom are ominous symptoms and, along with persistent tachycardia or tachypnea or arterial desaturation, should prompt a search for a leak.

Upper gastrointestinal tests performed on the first postoperative day detect 33% of all leaks with a specificity of 100%,[49] with this early detection translating to lower morbidity[50] and significantly shorter hospital stay.[49] The absence of an early contrast study results in an average time to diagnosis of 7 days for gastrojejunal leaks and a mortality of approximately 10%.[51]

While a negative result for an upper gastrointestinal test on the first postoperative day is reassuring, it should be remembered that the peak incidence of leaks (by clinical or radiologic criteria) is on day 5.[24] A negative result must always be overridden by clinical findings of tachycardia or respiratory distress.[52]

In clinically suspected leaks, with negative radiologic findings, abdominal cavity inspection should be done, preferably laparoscopically. In the presence of a contained or well-drained leak in a hemodynamically unstable patient, nonoperative management is recommended.[24,53] Management consists of intravenous antibiotics, parenteral feeding or via a gastrostomy tube placed under radiologic or laparoscopic guidance. Localized collection can be drained percutaneously under radiologic guidance.

In our experience of 40 leaks complicating 2675 consecutive LRYGBs, only 10% of the leaks required a laparotomy; 30% required laparoscopic feeding access placement (gastrostomy tube) while 60% were managed nonoperatively with no deaths or long-term morbidity. This approach differs from the more aggressive stance advocated by others[54] who propose early operative intervention for all patients with leaks.

An uncontained leak or one associated with hemodynamic instability requires urgent operative intervention. This should consist of repairing the leak, placement of drains, and the creation of enteral feeding. If the patient is hemodynamically stable, this could be managed laparoscopically.

Gastrointestinal Hemorrhage

Upper gastrointestinal (UGI) bleeding (24 hours following LRYGB) usually results from inadequate hemostasis at the gastric remnant staple line or the gastrojejunostomy.[55] Use of low molecular weight heparins after induction of anesthesia can predispose to a general ooze or more significant hemorrhage. Operative intervention may be necessary in about 40% of cases, depending on the rate of blood loss and hemodynamic stability.[55] Angiography with embolization is not a useful option in the vascular stomach with its multiple arterial supply.

Intestinal Obstruction and Internal Hernias

The rate of postoperative bowel obstruction following laparoscopic bariatric surgery ranges from 0.6% to 3.5%.[24,25] The mean time to presentation is variable, with some series reporting early obstruction (within 15 weeks) after a retrocolic approach,[56] but others reporting later presentation with the antecolic approach (1 to 3 years).[57]

Unlike open bariatric procedures where adhesive obstruction is most common, intestinal obstruction after laparoscopic gastric bypass is caused primarily by nonadhesive disease. Causes of post-LRYGB intestinal obstruction include internal hernias, formation of mesocolic constrictions, anastomotic strictures, intussusception, and volvulus or kinking of the bowel distal to the Roux limb at the site of the jejunojejunostomy. Internal hernias constitute the most common cause of intestinal obstruction after laparoscopic bariatric surgery and may be explained by the relative lack of adhesions which in the open situation facilitate fixation of the Roux-limb, thus preventing its displacement and closing mesenteric defects.[58] The high proportion of adhesive obstruction (38%) in the series reported by Champion[57] may be a reflection of the fact that 55% of their obstructed patients had previously undergone an open abdominal procedure.

The most common site of obstruction with a retrocolic Roux loop is the mesocolic window, especially through the dorsal and lateral aspects of the defect.[56] Internal hernias can occur at any defect created during gastric bypass procedure. These defects include the transverse mesocolic window, the jejunojejunostomy mesenteric defect, and the space between the transverse mesocolon and the mesentery of the Roux limb (Petersen's defect). Some internal hernias occur at more than one site.[58] Furthermore, rapid weight reduction following gastric bypass may result in decreased intraperitoneal fat that may enlarge the mesenteric defect, facilitating hernia formation.[53]

Intestinal obstruction may be incomplete or intermittent. Internal hernias often present with intermittent postprandial abdominal pain with contrast radiology that may be completely normal in up to 20% of cases.[58] The initial investigation should be a UGI contrast study. Hold-up of contrast at the gastrojejunostomy should call for endoscopic evaluation, while Roux limb obstruction usually indicates obstruction at the mesocolic defect where a retrocolic route had been used. A CT scan may be needed to supplement a UGI contrast study if any doubt exists about the diagnosis of obstruction, especially that distal to the Roux limb.

Access to the gastrointestinal tract and its evaluation may be very challenging after LRYGB. Some radiological studies are useful for depiction of normal anatomy and diagnosis of complications after gastric bypass surgery. Helical computed tomography (CT) assesses the normal postoperative gastrointestinal anatomy and complications such as leaks, staple line dehiscence, bowel obstruction, abscess, hepatic or splenic infarction, and hernia. Anatomical structures, including the gastric pouch, excluded stomach; proximal efferent loop, oversewn jejunal loop, and distal jejunojejunal anastomosis are easily identified. When the fundus of the excluded stomach is filled with air or fluid, it can be misinterpreted as a loculated fluid collection.[59]

Not all radiologically detected abnormalities require surgical intervention. Some, considered minor, may be resolved by radiologic intervention. Some late complications, like internal hernias may have a variety of findings and usually require complementary upper GI series and CT. Leaks are usually early complications, most often originating from the gastrojejunal anastomosis; findings from upper GI series and CT have demonstrated extraluminal gas, contrast material, or both. Anastomotic strictures seen as late complications are diagnosed with upper GI series with rounded dilation of the pouch and delayed emptying.[53]

Radiological and endoscopic evaluations of the bypassed stomach and duodenum are very difficult. Little is known about long-term physiologic and histologic changes that occur in these bypassed organs.

All patients who present with intestinal obstruction must undergo surgical exploration, laparoscopically whenever possible. Laparoscopic exploration should be preferred as an initial approach, and in the vast majority of obstructive complications, the underlying cause can be effectively treated.[25] Operative treatment primarily includes hernia reduction and closure of all mesenteric defects. Early and aggressive management of intestinal obstruction after gastric bypass is essential to prevent the dangers of closed loop obstruction and acute dilatation of the remnant stomach. Morbidity remains high, with an incidence of perforations at 9.1% and death at 1.6%.[58]

Internal hernias can be prevented by meticulous closure of all potential defects with a continuous running technique.[58] The adoption of nonabsorbable sutures resulted in a decrease of 50% in internal hernia formation.[25] Jejunum distal to the jejunojejunostomy may be prevented from kinking by placing a single nonabsorbable stitch between the jejunum immediately distal to the anastomosis and the stapled end of the biliary limb ("Brolin stitch").[60] Antecolic placement of the Roux limb is associated with a lower risk of obstruction (0.43%) compared with obstruction with a retrocolic loop (4.5%).[57]

Acute Gastric Dilatation

Acute dilatation of the gastric remnant is a rare (0.6%) but potentially catastrophic event resulting from the closed-loop obstruction that follows obstruction of the bilio-pancreatic limb.[61] Severe epigastric pain in conjunction with gastric dilatation on a plain abdominal x-ray or CT scan is diagnostic. It leads to rapid clinical deterioration with blowout of the staple line and hemodynamic instability that may present ab initio with cardiac arrest.[62] It requires urgent percutaneous gastrostomy tube decompression and subsequent management of the underlying biliary limb obstruction.[63]

Rhabdomyolysis

This is a rare complication typically affecting the superobese male patient who lies supine during a long operative procedure. It results from a gluteal compartment syndrome resulting in myonecrosis.[64-66] It has a 50% mortality rate that rises to 100% in those progressing to renal failure.[64] Preventive measures include providing adequate buttock padding and reducing the duration of the surgical procedure, especially in the superobese male. Early identification requires serial creatinine phosphokinase (CPK) measurements. Median CPK rise in uncomplicated patients is 1 200 IU/L (SD 450 to 9 000), but in affected patients it ranges from 26,000 to 29,000 IU/L. If CPK rises above 5 000, aggressive hydration and forced mannitol diuresis should be started.[64]

Gastrojejunal Anastomotic Strictures

In 3% to 12% of patients undergoing gastric bypasses, gastrojejunal anastomotic strictures occur. Patients present with gastric pouch obstruction at between 3 weeks to 60 weeks after surgery.[67-69] These lesions are believed to result from ischemia at the site of the anastomosis or from subclinical anastomotic leaks. The effect of the type of anastomotic technique is not clear, with some reporting fewer strictures with the use of linear staplers or hand-sewn anastomosis when compared with circular staplers.[70] When circular staplers are used, a 25-mm anvil causes fewer strictures compared with a 21-mm anvil, without adversely affecting weight loss.[71] Others have reported equal stricture rates between linear and circular staplers.[72]

Painless postprandial regurgitation is the principal presenting symptom and should lead to a UGI contrast study. The diagnosis is confirmed by the inability to pass a 9-mm endoscope through the anastomosis.[69]

Treatment consists of endoscopic balloon dilatation (13 mm to 18 mm)[69,73] of the anastomosis. An average of 2 separate procedures relieves the obstruction in 95% of cases[67] for strictures presenting early, but restenosis occurs in 3% of these patients.[69] Strictures presenting after 3 months are still amenable to endoscopic dilatation, but up to a third of patients may require operative revision.[74] Fluoroscopy guided dilation is an alternative treatment, achieving sustained patency in 71% of patients after 1 dilatation.[75]

Marginal Ulcers

Ulcers at the site of the gastrojejunal anastomosis complicate between 1% to 16% of isolated gastric bypasses[76,77] with the highest risk in the first 2 months after surgery,[68] but may develop as late as 10 years.[68] Its cause is multifactorial, usually being associated with use of nonabsorbable suture material[78] and gastric pouch size larger than 50 mL.[79,80] Nonsteroidal anti-inflammatory agents and *Helicobacter pylori* have also been associated with marginal ulcers. Patients who were preoperatively screened and treated for *H. pylori* had a significantly lower incidence of marginal ulcers at 3 years (2.4%) compared with those who were not screened for *H. pylori*.[81] Alcohol and smoking have also been causally implicated in patients with marginal ulcers.[82]

Pouch ulceration heals with proton pump inhibitors or sucralfate along with cessation of nonsteroidal antiinflammatory drug intake and smoking. In patients with a large pouch, ulcer recurrence with medical therapy alone is common, and in this case consideration should be given to a reduction in the pouch size along with excision of the ulcer.[76,79] Recurrent ulceration associated with a foreign body (including sutures) requires removal of the foreign body.

Incisional Hernias

One of the main advantages of laparoscopic gastric bypass is the dramatic decrease in incisional hernias (0.7%).[24] In open gastric bypass, the rate of this complication ranged from 15% to 20%.[83-84] The 10-mm ports can cause Richter's type hernias.[85] Port-site hernias following the laparoscopic approach have a small defect that renders them prone to intestinal strangulation. Herniations at the trocar sites are best-demonstrated radiologically by using anterior abdominal wall ultrasound or by CT scan.

Prevention includes closing the fascia of 10-mm and 12-mm port sites using nonabsorbable sutures.[85] Once recognized, port-site hernias should be managed urgently, with laparoscopic reduction and suture repair of the hernia defect using a nonabsorbable material.

Protein-calorie Malnutrition

Long-limbed gastric bypass, with a 50-cm common channel, results in protein-calorie malnutrition in 28.5% of patients.[86] Low serum albumin and phosphate levels indicate depletion in total body proteins.

Excessive malabsorption may be reversed by conversion to a 150-cm to 200-cm common channel. It is important to pay attention to thiamine replacement and to avoid the refeeding syndrome.[87-89]

Metabolic Bone Disease

Metabolic consequences of laparoscopic Roux-en-Y gastric bypass may also include increased bone turnover weight loss. Markers of bone turnover were significantly elevated in patients post-LRGB compared with controls. Bone mineral density decreased significantly. Within 3 months to 9 months after LRGB, morbidly obese patients have an increase in bone resorption associated with a decrease in bone mass.[90]

This is an insidious long-term complication of gastric bypass and arises from calcium or vitamin D malabsorption, or both.[91,92] Loss of bone mass, resulting from osteoporosis or osteomalacia, is preceded by secondary hyperparathyroidism and is asymptomatic until complicated by pathologic fractures. Elevation in serum immunoreactive parathyroid hormone associated with low or normal calcium levels is the earliest indicator of this condition and should prompt dietary supplementation with calcium and vitamin D and close monitoring of lumbar spine and femoral neck bone mineral density.[93]

Micronutrient Deficiency

Deficiency of iron (47%), folate (35%), and vitamin B12 (37%) are common postoperatively and contribute to the development of anemia found in 54% of patients.94 Iron deficiency anemia occurs in 22% of men and 51% of women,[94] with a higher proportion in menstruating women.[95] Routine administration of the micronutrient supplementation following gastric bypass is recommended.

Cholelithiasis

Routine cholecystectomy concomitant with LRYGB remains controversial.[96,97] On the other hand, weight loss following LRYGB is accompanied by a rise in the incidence of gallstones, with 38% to 52.8% of patients who preoperatively did not have stones, going on to develop stones in the 12 months after surgery.[98,99] Between 15% and 27% of all patients, irrespective of gallstone status at LRYGB surgery, will require urgent cholecystectomy within 3 years.[98,100]

When considering contraindications for the combined procedure, it should be noted that it nearly doubles length of hospital stay and adds about 50 minutes to the operation.[101,102] The prophylactic use of oral ursodiol at 60 0mg daily for the 6 months after LRYGB significantly reduces the incidence of gallstones (2% vs. 32% in placebo, $P<0.01$).[103] The decision for prophylactic removal of the gallbladder will have to be made individually.

The management of postgastric bypass choledocholithiasis becomes difficult because of the loss of endoscopic access to the duodenum.

Weight Regain

Failure of weight loss after LRYGB occurs in 5% to 10% of patients. It is thought to arise from a progressive dilatation of the pouch outlet and the pouch itself and is probably related to poor eating habits.[32,204,105] Patients can also defeat the restrictive component of the operation by consuming sweets or other high caloric foods despite feeling full. This can be a difficult problem with no satisfactory solution. The best results are achieved by frequent patient supervision and close cooperation with nutritionists, psychologists, and support groups. The value of reducing pouch or stoma size either operatively or endoscopically remains unproven despite some reports to the contrary.[32,106]

SPECIAL CONSIDERATIONS

Patients With Diabetes Mellitus

The surgical treatment of morbid obesity leads to dramatic improvement in the comorbidity status of most patients with type II diabetes mellitus. In our series, a significant reduction in the use of oral antidiabetic agents and insulin followed surgical treatment. Patients with the shortest duration (<5 years), the mildest form of type II diabetes mellitus (diet controlled), and the greatest weight loss after surgery are most likely to achieve complete resolution of type II diabetes mellitus. Early surgical intervention is reasonable to increase the likelihood of rendering patients euglycemic.[107]

Adolescents

Obesity has become a significant problem in adolescents. Many patients do not respond to dietary modification, exercise regimens, or pharmacological treatment. For many of these young patients, weight reduction surgery may be a reasonable alternative. Previous experiments with open gastric bypass indicated significant morbidity, and the initial enthusiasm for this approach has diminished. In our experience with laparoscopic Roux-en-Y gastric bypass, patients under 20 years of age may receive great benefit from this type of surgery.[108] Patients with >20-month follow-up lost an average of 87% of their excess body weight and had nearly complete resolution of comorbidities (including hypertriglyceridemia, hypercholesterolemia, asthma, and gastroesophageal reflux disease). Laparoscopic gastric bypass is a safe alternative in morbidly obese adolescents who have not responded to medical therapy.[108]

Elderly Patients

Some surgeons have considered age 50 years as a relative contraindication for bariatric surgery. Gonzales et al[109] reported interesting comparisons between the laparoscopic technique and open technique for Roux-en-Y gastric bypass in older patients. They demonstrated the safety and efficacy of Roux-en-Y gastric bypass (RYGB) in the group patients 50 years of age who underwent RYGB. The percentage of excess body weight loss was 66% at mean follow-up of 12 months. Blood samples drawn after a mean of 8 ± 2 months revealed no postoperative metabolic alterations. RYGB resulted in a significant reduction in comorbidities like hyperglycemia, hypertension, degenerative joint disease, gastroesophageal reflux disease, and continuous positive airway pressure-dependent sleep apnea. The laparoscopic approach resulted in fewer intensive care unit admissions and shorter length of stay when compared with those in open surgery. Authors concluded that RYGB is safe and well tolerated in patients 50 years resulting in no renal, hepatic, or electrolytic alterations. Weight loss and control of obesity-related comorbidities are satisfactory.[109]

Our experience demonstrates the safety and effectiveness of LRYGB in patients older then 65. This population has a different profile of preoperative comorbidities. The majority of older patients are referred with degenerative joint disease (DJD), hypertension, stress urinary incontinence, and sleep apnea. We noticed significant improvement or complete resolution in patients with DJD and stress urinary incontinence following LYGB. Older patients benefit significantly from bariatric surgery, with an acceptable postoperative mortality and morbidity rate. Age per se should not be a contraindication to bariatric surgery, provided adequate patient evaluation has taken place.

Cirrhosis

Some controversies arise when dealing with cirrhotic patients. The safety and efficacy of bariatric surgery in patients with cirrhosis has not been well studied. In our experience, 1.4% of patients with cirrhosis underwent LRYGB. In most cases, the laparoscopic approach allows making the intraoperative diagnosis of cirrhosis. Laparoscopic RYGBP in the cirrhotic patient has an acceptable complication rate and achieves satisfactory early weight loss, despite the fact that cirrhotic patients tend to be heavier, older, and more likely to have diabetes and hypertension.[110]

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