Laparoscopic Management of Complicated Ulcer Disease

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Laparoscopic surgery for complicated ulcer disease has to be tailored to the specific needs imposed by the pathology and clinical state of the patient. In the elective situation, patients with concomitant reflux esophagitis and duodenal ulcer disease are best treated by partial crurally-fixed posterior fundoplication and highly selective vagotomy. Patients with resistant prepyloric ulcers and those on long-term medication with ulcerogenic drugs require truncal vagotomy and antrectomy. Because many patients with benign pyloric stenosis are elderly and exhibit hypochlorhydria, a drainage procedure without vagotomy is sufficient. The type of drainage performed, gastrojejunostomy or pyloroplasty, depends on the extent of scarring of the antroduodenal segment. In the emergency situation, patients with perforated ulcer disease are best treated by simple closure with adequate peritoneal toilet. A definitive procedure should be reserved for fit patients with prior symptoms and limited chemical peritonitis of less than 6 to 8 hours duration. All perforated gastric ulcers should be biopsied at the time of laparoscopic closure. New endogastric techniques are being evaluated for the treatment of patients with bleeding gastroesophageal lesions.

The current management of acute gastrointestinal bleeding entails recourse to interventional flexible endoscopic procedures, newer laparoscopic endogastric approaches are being evaluated and may be of special value in problematic patients.

Duodenal Ulcer and Reflux Disease

The coexistence of significant ulcerative gastroesophageal reflux disease (GOR) in some patients with duodenal ulcers is well documented and poses management problems both with medical and surgical treatment. The incidence of significant GOR in patients undergoing open vagotomy in the reported literature varies considerably, and information on the extent of this problem in patients subjected to laparoscopic ulcer surgery is not currently available. In our own institution, coexisting peptic ulcer disease and erosive esophagitis has been encountered in 2 of 30 consecutive cases with ulcer disease. In a consecutive cohort of 187 patients with intractable GOR undergoing laparoscopic antireflux surgery, 14 had coexisting active or remitted disease.

When documented by endoscopy and pH monitoring before surgery for duodenal ulcer disease, reflux affects the procedure performed because the dissection of the lower esophagus and the gastroesophageal junction is likely to aggravate the incompetence at the cardia. In common with the Liege group, a laparoscopic highly selective vagotomy (HSV) combined with an antireflux procedure is favored in these patients. Our preference is for a crurally fixed 270° partial Toupet fundoplication. With the laparoscopic approach, the fundoplication is performed after the HSV has been completed. Closure of the hiatus is rarely necessary because these patients do not usually have a demonstrable hiatal defect or actual herniation of the stomach. The fundal wrap is brought around the esophagus from the right side, inside the nerves of Latarjet and is initially sutured to the right and left crus before being stitched to the anterolateral walls of the esophagus on either side (Fig 1).
Resistant or Recurrent Prepyloric Ulcer

Parietal cell vagotomy procedures are accompanied by unacceptably high nonhealing and recurrence rates in patients with prepyloric ulcers. In these patients, the only effective surgical management consists of bilateral truncal vagotomy and antrectomy. This operation is also performed in patients referred for duodenal ulcer surgery who require long-term steroid therapy for medical disorders such as asthma.

Bilateral truncal vagotomy and antrectomy are both tedious and protracted if straight laparoscopic instruments are employed. The use of curved coaxial instruments introduced through flexible cannulas expedites the procedure. The operation starts with exposure of the hiatus, dissection of the abdominal esophagus, and performance of a bilateral truncal vagotomy. Complete dissection of the esophagus with division of all identifiable vagal branches, including the nerves of Grassi, is especially important in these patients. The use of digital enhancement (Digivideo, Stortz, Tuttlingen, Germany) helps in the identification and division of these accessory nerve fibers by the electrosurgical hook-knife.

The pylorus should be marked by a suture on its anterior surface before the surgeon commences the mobilization of the antrum because otherwise subsequent determination of the appropriate distal limit of the resection becomes difficult, and the surgeon incurs the risk of leaving antral tissue behind that will then be continually exposed to the alkaline duodenal pH causing persistent hypergastrinemia and recurrent ulceration in the gastric remnant. The antral mobilization on the greater curvature side extends from the junction of the upper with the lower third of the organ up to the right gastro-epiploic vessels in the infrapyloric region. This mobilization can be performed with ligatures using external slipknots or by use of the EndoGIA (United States Surgical Corporation, Norwalk, CT) stapler (vascular cartridges). With either technique, an initial avascular window must be opened to gain entry into the lesser sac.

The stomach is then elevated, and any adhesions between its posterior surface and the pancreas are divided. A curved duckbill forceps is then passed behind the stomach and used to push and tent the lesser omentum forward, facilitating its division. The left gastric vessels are suture ligated in continuity close to the mobilized lesser curvature 1.0 cm proximal to the proposed proximal transection line, and the right gastric artery is ligated proximally and clipped distally (near the stomach).

Either a Billroth I or a Polya procedure may be performed, although the latter is technically much easier. If a Polya procedure is intended, the duodenum is completely stapled and transected with the endoGIA (with blue cartridges) just distal to the pylorus. The proximal gastric transection is performed by stapling from the greater curvature side (6.0 cm stapler with blue cartridge) as far as the lesser curvature a few centimeters distal to the ligated left gastric vessels. The Polya antecolic anastomosis is performed using the 6.0 cm stapler between the anterior wall of the gastric remnant and an upper jejunal loop approximately 40 to 50 cm from the Treitz ligament. On completion, the anterior wall of the anastomosis is lifted up to inspect the interior and to exclude mucosal bridges. The defect at the site of insertion of the stapler is closed with a running deep seromuscular suture.

For Billroth I reconstruction, the EndoGIA stapler is applied from the lesser curve side such that the ends of the stapler limbs when closed exclude a 3.0 cm portion of stomach along the greater curvature. The unstapled portion of the stomach is then divided using the L-shaped electrosurgical hook-knife. A laparobag is introduced through the left 12.0 mm subcostal cannula, and the detached antrum placed inside the bag. Extraction of the antrum is best delayed until the continuity of the gastrointestinal tract has been restored. An end-to-side Billroth I gastroduodenal anastomosis is fashioned along an oblique line running from the top stapled corner of the duodenal stump to the upper aspect of the
anterior wall of the second part of this organ. A hand suturing technique is used. The upper corner seromuscular suture is passed through the stomach and the duodenum medial to the upper end of the stapled line and tied. A corresponding corner suture is placed at the lower end and, after it is tied, the tail is grasped by the assistant. The posterior suture line is effected in a continuous fashion using deep seromuscular bites, and the suture is tied to the tail held by the assistant. The duodenum is then opened with cutting electrocautery alongside the completed posterior suture. Often bile flowing from the second part of the duodenum obscures the field. In this situation, a 12 Fr Foley catheter is placed inside the second part of the duodenum, and the balloon is inflated with air. The anterior wall of the anastomosis is sutured either with a continuous or interrupted technique using inverting sutures (Fig 2).

With each type of restoration of continuity, air is injected on completion through the nasogastric tube to test the integrity of the anastomosis. Thereafter, the stomach is deflated and nasogastric tube is left in situ. The antrum is extracted inside the laparobag through one of the subcostal cannulas, after the placement of a speculum-type retractor to distract the wound edges.

Perforated Ulcers

The results of a randomized trial between laparoscopic and open surgical management being conducted in Hong Kong by Stuart and Chung appears in this issue. On a priori grounds, it seems unlikely that laparoscopic management will reduce the postoperative in-hospital recovery period because this is determined largely by the severity of the peritonitis, the associated ileus, and certainly the experience reported from the various centers indicate that the period of hospital stay is the same with the two management approaches. Nonetheless, there is the potential for reduction of postoperative respiratory complications, especially in the elderly age group. An accelerated return to full activity has also been observed among patients older than 60 years of age subsequent to discharge from the hospital. There has been a legitimate concern that laparoscopic management of perforated ulcer disease may be accompanied by a higher incidence of intra-abdominal abscess formation because of inadequate peritoneal toilet. Although this has not been reported from any of the centers including our own to date, the issue will only be resolved with prospective clinical studies.

Aside from the various techniques of closure of the perforation, the question of definitive laparoscopic ulcer surgery at the time of perforation remains unresolved. In addressing this issue, the following are considerations in favor of simple closure with peritoneal debridment as opposed to a definitive antiulcer procedure: increasingly these patients are elderly, laparoscopic HSV takes an average of 4 hours, and with the establishment of effective medical therapy designed to eradicate Helicobacter pylori infection, permanent healing of duodenal ulcer disease is expected in 70% of patients.

Certainly, this investigator believes that emergency HSV (laparoscopic or open) should only be contemplated if the patient is fit, has a long history of ulcer disease, and the peritonitis is of short duration (6 to 8 hours). Moreover, the surgeon attempting the procedure laparoscopically for perforated duodenal ulcer disease should be experienced in laparoscopic HSV in the elective situation.

Although the laparoscopic management of perforated gastric ulcers is similar, it is important that these ulcers should be biopsied at the time of emergency suture closure because a small but definite percentage will be malignant in nature, such as adenocarcinoma or lymphoma (one in our series). To avoid sampling errors, a four-quadrant biopsy is recommended in the literature, although this investigator prefers to excise the ulcer using electrosurgical cutting and submit this for histological examination. Although this creates a larger defect for closure, it guarantees a definitive diagnosis and results in more healthy tissues for approximation by continuous suture.
Ulcer Disease With Pyloric Outlet Obstruction

The practical issues here are the extent of fibrosis and deformity of the pylorus and the degree of residual gastric acidity, as measured by basal and pentagastrin acid stimulation. Many elderly patients with pyloric obstruction have hypoacidity by the time they present with pyloric obstruction. A bilateral truncal vagotomy is unnecessary in these patients, and a simple laparoscopic drainage procedure suffices.

Complete Bilateral Truncal Vagotomy

A complete mobilization of the abdominal esophagus and esophagogastric junction is necessary for a complete bilateral truncal vagotomy. The peritoneum over the hiatal margin is divided, and the phrenoesophageal membrane is identified and teased up with blunt pledget dissection. The left and right margins of the esophagus are mobilized from the right and left crura, respectively. This mobilization requires the division of some of the attachments of the phrenoesophageal membrane. Thereafter, the areolar tissue of the mediastinum is exposed, and by blunt dissection from both sides, the esophagus is mobilized from inside the hiatal canal. At this stage, a curved coaxial duckbill grasper is passed from the left side behind the esophagus to emerge on the right side of the esophagus. A sling is passed around the esophagus and is used to pull the organ away from the crura and the mediastinum. The posterior vagal trunk is identified in the fatty tissue between the lower end of the right crus and the esophagus. A 1-cm resection of this trunk is performed between clips. This is followed by identification of the anterior vagal trunk that is lifted from the anterior wall of the esophagus by a curved coaxial grasper and resected in a similar fashion. Clearance of the abdominal esophagus of accessory nerve fibers is an essential component of a bilateral truncal vagotomy. The entire circumference of the mobilized abdominal esophagus is cleared of any nerve fibers using the electrosurgical hook-knife, as previously described.

Choice of Drainage Procedure

The selection of the drainage procedure whether a truncal vagotomy is included depends on the state of the antropyloric region as assessed laparoscopically with concomitant flexible endoscopy. If the pylorus is grossly deformed with considerable fibrosis and marked stenosis, a stapled antecolic anastomosis between an upper jejunal loop and the antrum of the stomach is the procedure of choice.

Pyloroplasty

Adequate elevation of the quadrate lobe is essential for the performance of a Heinicke-Mickulicz pyloroplasty. The stomach is kept empty and collapsed by the continuous low suction via a size 16Fr Salem sump nasogastric tube throughout the procedure.

The exact position of the pylorus is identified by reference to the prepyloric Mayo veins, and a stay suture is inserted at its lower border, tied internally, and then cut approximately 3.0 cm from the knot. The proposed pyloroplasty incision is mapped with soft electrocoagulation. The coagulated line runs horizontally in the center of the antropyloro-duodenal segment and extends from the duodenal bulb across the pyloric sphincter to the adjacent antrum over a distance of 4.0 cm. The incision is deepened preferably using bipolar electrocutting in the autocoagulation modes. During this step, an insulated forceps is held in the left hand and is used to grasp and coagulate bleeding submucosal vessels, as and when they are encountered. On completion, traction is applied to the suture previously applied to the lower border of the pylorus, converting the horizontal incision to a vertically disposed rhomboid defect. Interrupted all coats inverting sutures are used to fashion the pyloroplasty. As traction is maintained on the stay suture, the first stitch approximating the margins of the proximal end of the rhomboid is inserted, tied internally, and cut long. The assistant then grasps the long ends of the first tied suture, to facilitate the insertion of the second suture, and the process is repeated until the lower 1.0 cm of the defect is reached. The last two sutures are inserted before being tied. If a Foley balloon catheter has been placed in the second part of the duodenum, the balloon is deflated and the catheter removed before the last two sutures are tied. Once the suturing of the pyloroplasty has been completed, the suction on the nasogastric tube is disconnected, and air is injected using a 50.0 mL syringe to test the integrity of the suture line.

Gastrojejunostomy

Although either an anterior or a posterior (retrocolic) anastomosis can be performed laparoscopically, the antecolic procedure is undoubtedly easier,
and the stapled technique is considerably quicker than the hand-sutured method.

The ideal site of the anastomosis of the jejunal loop is with the antrum along its greater curvature. A loop of upper jejunum approximately 40 to 50 cm from the duodenojejunal junction is selected. This step requires elevation of the left half of the transverse colon by the assistant as the surgeon follows the upper jejunal loops to the Treitz ligament. This is an important step of the procedure, and the surgeon should desist from picking up an upper jejunal loop because an inadvertent gastroileostomy may be performed. The selected loop is marked by a serosal suture.

The gastric antrum is then prepared for approximation with the selected jejunal loop by ligature and division of two vessels supplying the greater curvature from the gastro-epiploic arcade at the proposed site of the anastomosis. This devascularization of the greater curve at the selected site can also be performed using the EndoGIA* loaded with vascular cartridge. Thereafter, the stomach and the jejunal loop are aligned and held together by the insertion of two corner, deep seromuscular sutures at either end, approximately 6.0 cm apart. The left corner stitch is inserted first, tied internally using a standard microsurgical knot, and then cut long. Traction is kept on this suture as the right corner suture is inserted though the two organs, tied, and left uncut. This suture is subsequently used to close the defect created for the insertion of the stapler (vide infra). As traction is held on the tail of the right extremity suture, appropriate sized openings are made in the jejunum and stomach (medial to the suture) using the hook-knife with high-frequency electrocutting for the insertion of the limbs of the EndoGIA* stapler. The two limbs of the opened 6.0 cm gas-powered EndoGIA stapler are introduced into the stomach and the jejunum respectively. Once inside the lumen of the stomach and jejunum, the stapler limbs are elevated to tent the two organs and then closed before the instrument is fired. Thereafter, the stapler heads are released and withdrawn from the anastomosis. The anterior wall of the gastrojejunostomy is then lifted up to inspect the stapled anastomotic line and to ensure that there are no mucosal bridges. The residual defect after the removal of the stapler is closed by a running deep seromuscular suture (Fig 3). Although some surgeons close the defect by a tangential application of the stapler, this practice is inadvisable because it will result in significant narrowing of the efferent limb of the gastrojeunostomy. At the end of the procedure, air is injected through the nasogastric tube to distend the stomach and test the integrity of the anastomosis after which the stomach is deflated.

Figure 3. Anterior gastroenterostomy for pyloric stenosis.

Posterior gastrojejunostomy commences with the opening of the lesser sac opposite the middle third of the stomach by ligature and division of the vessels supplying the greater curvature from the gastro-epiploic arcade. The left half of the transverse colon is lifted up by the assistant, and the middle colic vessels are identified. A 3.0 cm opening is cut by scissors in the transverse mesocolon just to the left of the middle colic vessels. An upper jejunal loop approximately 20.0 cm from the Treitz ligament is grasped by anatraumatic forceps and inserted through the defect into the lesser sac. At this stage, the transverse colon and greater omentum are released and allowed to drop over the grasper holding the bowel. A coaxially curved Babcock’s grasper is applied to the anterior wall of the mobilized greater curvature that is then pulled up to expose the lesser
Figure 4. Operating laparoscope used for laparoscopic-endogastric surgery.

sac, the posterior surface of the stomach, and the transposed jejunal loop held by the infracolic grasper. After the assistant grasps the jejunal loop with an atraumatic forceps, inserted into the lesser sac between the transverse colon and the stomach, the infracolic grasper is released. The transposed jejunal loop is secured to the posterior surface of the stomach by the right corner suture that is left uncut after it is tied. The assistant then releases the jejunal loop. The left corner suture is then inserted approximately 6.0 cm proximally, tied, and cut. The anastomosis is fashioned using the endoGIA stapler as described previously, and the defect is closed using a running suture. On completion, the edges of the mesocolic defect are attached to the stomach by a few interrupted sutures above the anastomosis. No particular advantage has been observed with the posterior gastrojejunostomy over the anterior procedure, and the latter is preferred because it is technically much easier and can be completed in half the time.

Bleeding Peptic Ulcers

Currently, the standard technique for the emergency treatment of bleeding ulcer disease involves the use of flexible endoscopy with injection sclerotherapy, electrocoagulation (monopolar or bipolar) and photocoagulation using a variety of laser delivery systems. Although there has been no definite evaluation and experience is limited, techniques that involve the laparoscopic-endoluminal gastric approach are being evaluated in a number of centers including our own.

The laparoscopic-endogastric approach entails the insertion of a cannula through the abdominal wall into the stomach under laparoscopic control and is facilitated by concomitant flexible endoscopy. After the stomach is cleared of blood and clots by saline irrigation through the gastric cannula, the CO₂ line...
is transferred from the laparoscopic to the gastric cannula, and the stomach is inflated. An operating laparoscope that incorporates an instrument channel (Fig 4) is then inserted through the gastric cannula. A separate 5.5-mm cannula is placed through the anterior wall of the stomach via a separate puncture. In this fashion, two instruments can be placed into the gastric reservoir enabling suturing of bleeding lesions in addition to coagulation; one through the operating channel of the laparoscope and the other through the 5.5-mm port. A third instrument, inserted through the operating channel of the flexible endoscope can be brought into the operating field, if necessary (Fig 5). The laparoscopic-transgastric approach has the potential to deal with bleeding lesions that are difficult to control by the standard flexible endoscopic interventional techniques such as Mallory-Weiss tears, high lesser curve ulcers, and bleeding fundal varices. On completion of the intragastric procedure, the two stomach wounds are sutured. A nasogastric tube is left in situ. The technique has also been used for the endogastric excision of benign lesions of the stomach and early localized invasive gastric cancer. Further technical development is needed to improve the seal of the gastric cannula, to prevent its dislodgement from the stomach during the operation and to avoid the need for a separate operating port.

References