Laparoscopic Treatment Of Peptic Ulcer Disease And Its Complications

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Peptic ulcer disease will eventually affect more than 3-4% of the Occidental population. The medical management of this disease, including H2 Blockers, proton pump inhibitors and antihelicobacter therapy, has been well defined and has been very successful. However, the treatment of chronic duodenal ulcer disease has been less successful, thus subjecting these patients to long term disability. It is with chronic duodenal ulcer disease as well as with its complications, such as bleeding, obstruction or perforation, where the surgeon can impact, using laparoscopic surgical techniques as an added therapeutic option.

HISTORICAL BACKGROUND

Jaboulay performed the first vagotomy in 1901 in Lyon with Latarjet and Wertheimer reporting their evaluation of gastric denervation in dogs and in humans shortly thereafter.[1] Dragstedt and Owen based a proposal in 1943 for truncal vagotomy for chronic duodenal ulcers on their predecessors work, with the observation of gastric stasis following division of the vagus nerve leading to their addition of a drainage procedure to the vagotomy.[2] The drainage procedure included either a gastroenterostomy or a pyloroplasty and also resulted in dumping's syndrome, diarrhea, and other complications. Jackson developed other selective vagotomies in order to reduce acid production while avoiding stasis; however, his techniques were aggravated by the same problems of dumping, diarrhea as well as infarction of the lesser curve of the stomach.[3] Subsequently, Johnston developed highly selective vagotomy, which has fewer

side affects than truncal vagotomy, but it has an ulcer recurrence rate of 2-10% at five to ten years for expert surgeons and as high a recurrence of 20-40% for average surgeons.[4,5,6]

These highly variable results with existing operations led to the development of posterior vagotomy and anterior seromyotomy as first described by T. V. Taylor in 1982.[7,8] Its several advantages include the fact that it is a simpler operation and it is not as tedious as highly selective vagotomy and thus is less operator dependent. It achieves the efficacy of tmncal vagotomy without the side effects.

SURGICAL ANATOMY

Classical anatomy textbooks describe one esophageal plexus which corresponds to a single vagus nerve Iying diffusely in the midline. This nerve condenses into a large posterior trunk – the abdominal vagus – with all other branches termed collateracs. However, in the lower esophagus where vagotomy is performed, there exists 90% of the time a large posterior trunk and a second anterior trunk. The posterior trunk is always single and large, while the anterior branch is finer and is accompanied by one or two supplementary branches. At the level of the cardia, these two trunks divide. The anterior trunk divides to form the gastriohepatic branches which follow the upper part of the lesser omentum at the lower border of tlle left lobe of the liver. These branches then divide to form hepatic biliary and pyloric branches, the later which is important for pyloric and antral motility. Near the anterior wall of the stomach, the gastric branches coalesce to form the anterior nerve of Latarjet. This nerve runs 1-2 cm from the lesser curvature of the stomach to end as tlle "crow's foot" at the incisura 6 cm proximal to the pyloms.

The posterior trunk gives off two branches - a large celiac branch and a gastric branch. This celiac branch joins the right celiac ganglion forming with the greater splanchnic nerve the loop of Wrisberg. Some of its fibers also parallel the hepatic and the gastroduodenal arteries to the greater curvature of the stomach, although their role is minimal. The gastric branch reaches the posterior stomach forming the smaller posterior nerve of Latarjet, which also ends as a "crow's foot".

Two other anatomical features of the nerves are worth noting. Firstly, the gastric nerves do not anastomose within the stomach walls. Secondly the nerves are closely associated with blood vessels, especially in the region of the lesser curvature, and thus ischemia at the lesser curvature can occur with their dissection.

This description of vagal anatomy explains the different principles behind vagotomy:

1. ***Truncal Vagotomy*** - involves cutting of the main trunks proximal to their division, thus resulting in complete denervation of the stomach, pylorus, biliary tree and alimentary track.

2. ***Selective Vagotomy*** - preserves the extragastric branches but denervates the antrum. This operation is not widely performed any more.

3. ***Highly Selective Vagotomy*** - preserves the antral nerve supply by leaving the terminal branches of the nerve of Latarjet intact.

4. ***Truncal Vagotomy and Anterior Seromvotomy*** - is a combination of a unilateral posterior truncal vagotomy, without the side effects of bilateral truncal vagotomy, and a highly selective vagotomy.

This later technique is our preferred laparoscopic approach, with the principles of the operation based on anatomical studies of Latarjet who demonstrated that the secretory nerves, originating from the anterior and posterior gastric nerves, course through the superficial seromuscular layer of the stomach before penetrating the gastric wall beyond the vascular pedicles. Division of the secretory branches of the vagus nerve 1.5 cm from and parallel to the lesser curvature within the seromuscular layer only and without violation of any mucosa thus preserves the antipyloric branches of Latarjet's nerves and adequate motility of the antipyloric pump. Normal physiologic emptying of the stomach is maintained without the need for drainage procedures. Finally, although Taylor in 1979 favored posterior seromyotomy as well, in 1982, he proposed replacing this procedure with a posterior truncal vagotomy as previously advocated Hill and Barker in 1972 for highly selective vagotomy.[8,9] Thus, posterior vagotomy ensures total denervation without the side affects on the pancreas or the digestive tract as shown by Smith and Burge.[10]

Figure 1. Trocar position.

TREATMENT OF CHRONIC DUODENAL ULCER WITH LAPAROSCOPIC POSTERIOR TRUNCAL VAGOTOMY AND ANTERIOR SEROMYOTOMY

A. Patient Selection:

Patients who are candidates for laparoscopic surgery must meet the following criteria:

1. They have failed medical treatment on H2 blockers, proton pump inhibitors or triple antibiotic therapy or have had recurrences after complete medical treatment.

2. They are unable to comply with medical treatment because of socioeconomic factors.

3. They have experienced complications of peptic ulcer disease, including hemorrhage or perforation.

B. Preoperative Evaluation:

As in open ulcer surgery, preoperative evaluation is important, including upper endoscopy with biopsies as well as barium upper gastrointestinal series. Gastric pH studies to document basal and maximal acid output are necessary as well as a serum gastric level to rule out Zollinger Ellis syndrome. The patient is informed of the risk and benefits and is usually admitted the day before surgery.

C. Patient Positioning:

As in open surgery, general anesthesia is required with placement of a nasogastric tube and foley catheter. The patient is placed in the modified lithotomy position and prepped and draped with the operating surgeon between the legs of the patient, the nurse and first assistant on the left, and the camera assistant on the right.

D. Instruments:

The instruments are those used in usual laparoscopic procedures, including the 0° scope and a 30° scope for acute angle viewing, a variety of needle holders and atraumatic graspers. Other instruments include an angulated hook coagulator, endoloops, and absorbable monofilament sutures.

E. Trocar Positioning (Figure 1): Once the pneumoperitoneum is created using a varus needle, the first trocar is placed 3 cm above and to the right of the umbilicus and is for the laparoscope. A second trocar (5 mm) is placed in the subxiphoid position and is for a grasper or irrigation device. Two lateral trocars are placed and are for atraumatic graspers as well. The last trocar (12 mm) is placed 3 cm above and to the left of the umbilicus and is for other instrumentation. These five trocars, once in place, form a polygon.

F. Procedure: First the peritoneal cavity is explored to ensure feasibility of the operation with conversion to open surgery if the operation seems too dangerous or too difficult. The procedure then involves three steps approach to the hiatal area, posterior vagotomy, and anterior vagotomy.

1. Approach to the Hiatal Area - It is essential here to easily identify the landmarks in this region to explore the hiatus. The first step is to retract the left lobe of the liver with the xiphoid probe and to locate the avascular plane. The lesser sac is entered using graspers to hold the tissue and the hook coagulator for dissection. The dissection is continued until the right crux of the diaphragm is identified. The left gastric branch may be encountered at this point and can be divided if in the way.

2. Posterior Truncal Vagotomy (Figure 2) - The two landmarks for the posterior truncal vagotomy are the caudate lobe of the liver and the right crux of the diaphragm. The right crux is grasped and held to the right while the coagulator/dissector opens the preesophageal peritoneum area. At times, manipulation of the nasogastric tube is helpful to identify the position of the esophagus. The abdominal esophagus is then retracted to the left, and it is here were the posterior vagus nerve is easily identified by its white pearly color. Gentle traction is held on the nerve, and a 1 cm piece is transected between two clips with the segment sent to pathology. One should then confirm that the cardia and the hiatal areas are intact.

3. Anterior Seromyotomy (Figure 3) - This part involves performing a longitudinal incision on the anterior gastric seromuscular layer,

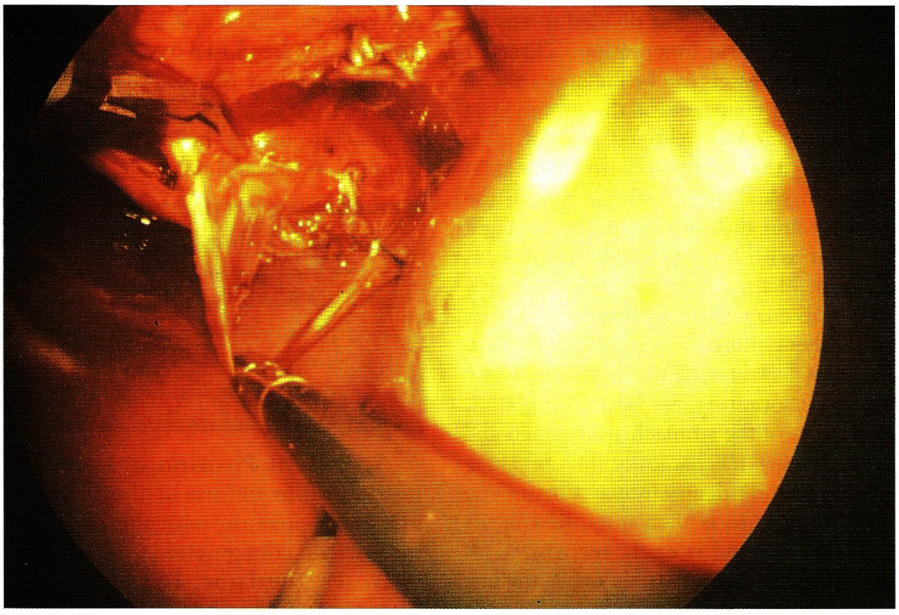

Figure 2. Laparoscopic right truncal vagotomy.

Figure 3. Laparoscopic Lesser Curve Seromyotomy.

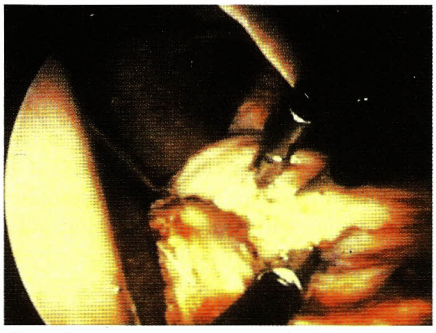

Figure 3a.

Figure 3b.

Figure 3c.

Figure 3d.

being careful not to incise the gastric mucosa, thus indirectly accomplishing a highly selective vagotomy of the anterior aspect of the stomach. The anterior aspect of the stomach is spread out between two grasping forceps and the line of the incision is outlined using electrocautery parallel to and 1.5 cm from the lesser curvature of the stomach and extending from the esophago-gastric junction at the posterior aspect of the angle of hiss to a point 5-7 cm from the pylorus at the level of the first branch of the "crow's foot". The two distal branches of the nerve are not divided to ensure adequate pyloric innervation. Three or four blood vessels can be encountered on the anterior surface of the stomach at this point and are clipped prior to performing the seromyotomy. The first assistant elevates the stomach with the grasper and the surgeon holds the right grasper with his left hand and uses his right hand to perform the seromyotomy with the coagulator to divide the serosa, the oblique muscles and finally the circular muscle layers of the stomach. Once the electrocautery has been completed, the edges of the stomach are grasped and spread apart mechanically thus breaking the remaining deep circular fibers. The gastric mucosa is then identified by its bluish color and is easily recognized. If an injury is suspected, air or methylene blue can be inserted into the stomach to look for leaks which can then be closed using sutures.

The seromyotomy is then closed using an overlapping running suture of 3-0 prolene through the 5 mm port. Alternatively, a stapling device can be introduced through a 12 mm trocar on the left periumbilical region and the stomach stapled using approximately 10 staples. It is important to note that the closure is overlapped to prevent possible nerve regeneration, although such regeneration has not been scientifically documented. Fibrin glue and electrocautery are used for hemostasis, and the hiatal area and the area of the seromyotomy are examined. The abdomen is deflated, the trocars are removed and the incisions closed with sutures.

G. Postoperative Management: Postoperative care is simple with early ambulation and resumption of oral intake 24 hours postoperatively with usual discharge in three days.

H. Complications: Complications occurring during this procedure include bleeding and perforation of the gastric mucosa. Bleeding can occur intra-operatively or post-operatively and usually involves gastric vessels that run across the anterior aspect of the stomach. It is best to identify and to divide these vessels prior to performing the seromyotomy. However, if hemorrhage does occur, it is essential to grasp the vessel with atraumatic forceps and to rinse the area and to precisely clip the vessel.

The second complication of perforation of the gastric mucosa can lead to peritonitis and therefore the stomach should be routinely filled with methylene blue to check for leaks which, if present, can be closed in an overlapping fashion. The way to avoid this complication is to stay above the mucosa and submucosa during the seromyotomy by traction on the stomach wall.

LAPAROSCOPIC TREATMENT OF GASTRIC OUTLET OBSTRUCTION GASTRIC OUTLET OBSTRUCTION IS ONE OF THE COMMON COMPLICATIONS OF PEPTIC ULCER DISEASE AND CAN BE TREATED WITH BILATERAL TRUNCAL VAGOTOMY AND GASTROJEJUNOSTOMY.

A. Patient Positioning: Patient is positioned as before in the modified lithotomy position with the trocars in the polygon configuration.

B. Procedure for Bilateral Vagotomy: The abdomen is explored for feasibility of the operation, including the ease with which the liver can be retracted. Posterior vagotomy is then performed as previously described. Next, the anterior vagotomy is completed by sectioning several trunks of the anterior vagus. Transsection of these fibers is facilitated by their accessible position on the esophagus. It is important, however, to roll the esophagus to the right to expose the left edge in order to not overlook some of the branches of the criminal nerve of Grassi.

C. Technique of Laparoscopic Gastrojejunostomy: The same ports are used; however, a lateral port is exchanged for a larger one for insertion of the endolinear cutter 60 (Ethicon Endosurgery, Cincinnati, Ohio). A loop of jejunum is identified, and the antimesenteric sides of the jejunum is approximated to the posterior aspect of the stomach's greater curvature using endoscopic Babcock clamps. Sometimes branches of the right gastric epiploic artery need to be freed for this anastomosis. A small gastrotomy and an antral incision are made, and the endolinear cutter and stapler is introduced. The surfaces are checked to be sure that the posterior and inferior aspects are free, and the stapler is fired, usually only one time. The laparoscope can then be inserted into the lumen to observe for hemostasis, and the gastrojejunostomy openings are closed in an open "V" fashion with sutures or an endolinear cutter. A reinforcing suture is placed at the apex of the anastomosis, hemostasis is obtained and the abdomen is irrigated. The trocars are removed and the incisions are closed.

LAPAROSCOPIC TREATMENT OF DUODENAL ULCER PERFORATION

Laparoscopic management of perforated ulcers is dependent on the timing of the perforation being the most appropriate for those patients presenting within twelve hours following ulcer perforation. Patients with a longer history may already have sealed and may be treated nonoperatively, while those presenting with signs of shock should be fluid resuscitated and treated by an open technique.

A. Technique: The patient is placed in the modified lithotomy position with the trocar position slightly modified. The scope is placed at the umbilicus, two lateral trocars are placed in the midclavicular line, and the fourth trocar is placed in the subxiphoid position. The diagnosis of a perforated ulcer is confirmed by the presence of a fluid collection, and any inflammatory adhesions, usually along the liver surface, are freed. The dissection is continued along the duodenum until the perforation is visible and a probe can be placed within a lumen to determine the size of the opening. Peritoneal lavage is then performed using approximately 8L of normal saline. The ulcer edge is then carefully debrided, removing any necrotic material.

Several methods of closure are available, all employing intracorporeal knot tying techniques. Due to the fragile nature of the duodenum extracorporeal knot tying is not used, as it usually results in too much tension on the structures. Two laparoscopic needle holders are used, with straight or curved needles and non-absorbable suture of 15 cm is usually employed.

Small perforations can be closed directly while larger perforations require an omental patch. Hemostasis is obtained and the operation is completed.

Another technique involves placing fibrm glue over the perforation and then gluing the omental patch to the opening. A nasogastric tube is then placed distally to the opening of the perforation and a drain is used as well. This technique was described by Champal of France in 10 patients with good results (Tissucol® Immuno AG. Vienna).

LAPAROSCOPIC TREATMENT OF RECURRENCES AFTER VAGOTOMY

Laparoscopic bilateral truncal vagotomy and antrectomy is an option for ulcer recurrence after previous vagotomy and ineffective medical treatment.

A. Technique: Bilateral truncal vagotomy is performed as previously described. The antrectomy is performed as an open surgery with the specimen usually being removed prior to the anastomosis. The antrectomy is begun by opening the gastrocolic ligament under the right gastroepiploic vessel using scissors. Vessels are secured with clips, and the stomach is retracted cephalad with Babcocks in order to expose the duodenum. The duodenum is then carefully dissected using atraumatic graspers and scissors. At the point, the right gastroepiploic is usually ligated as well as the right gastric artery using clips and endoloops.

The next step is to transect the duodenum and to close it using the endolinear cutter. The edges are inspected for hemostasis. Next, the antrum is exposed and the dissection is carried along the lesser curvature using the clip applier if necessary. In a 300 scope is useful to see the posterior aspect of the stomach well. Usually, the next step involves removal of the stomach using the endolinear cutter and the gastrojejunostomy is performed as previously described. The anastomosis is examined and hemostasis is assured completing the operation.

CONCLUSION

Laparoscopic posterior vagotomy and anterior seromyotomy is an added therapeutic option for the treatment of chronic duodenal ulcer disease refractory to medical therapy. Its results are easy to reproduce and surgeons can gain the necessary experience to perform this procedure in animal models. In addition, for the more experienced surgeon, other advanced laparoscopic procedures, including bilateral vagotomy and antrectomy or gastrojejunostomy, are alternatives to be explored. STI

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