The Collis-Belsey Procedure

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The addition of gastroplasty is an option in management for any antireflux operation (hiatal hernia repair) when it is anticipated that the repair alone may result in an unacceptable level of tension on the reconstruction. All of the commonly used standard repairs restore a segment of distal esophagus to an intra-abdominal position (Nissen, Belsey, Hill, and Toupet). The normal esophagogastric junction lies within the channel of the diaphragmatic hiatus, and even these standard repairs must exaggerate the length of the intra-abdominal segment of esophagus and may be assumed to create some degree of tension.

The primary indication for the addition of gastroplasty is that of acquired shortening because of mural scarring and vertical scar contracture in the wall of the esophagus, secondary to peptic esophagitis. This complication is a feature of an advanced stage of reflux esophagitis, which may include confluent ulceration of the distal squamous epithelium, peptic stricture, and acquired columnar-lined esophagus. Gross degrees of shortening are easily recognized from the barium radiograph, from endoscopic evaluation, and by the surgeon at the time of operation. Specific measurements of esophageal length can also be made at the time of esophageal manometry. A typical case is presented.

Case History

The patient is a 52-year-old construction worker who presented in 1985 with a 12-year history of florid, symptomatic reflux. His symptoms were characterized by retrosternal burning from xiphoid to neck, free and frequent acid regurgitation to the throat, fullness and belching, and postural aggravation of all symptoms (stooping, lifting, lying flat). For 7 years before presentation he noted increasingly troublesome episodes of dysphagia, with solid food sticking near the lower end of the esophagus at the lower retrosternal level. He experienced one episode of complete impaction with swallowed chicken that required endoscopic removal. The stricture had been dilated on several previous occasions with temporary relief. Medical treatment consisted of the usual dietary restriction, elevation of the head of the bed, and, in later years, the regular use of omeprazole and cisapride. Symptomatic control required the use of 40 mg of omeprazole daily. Even on this regimen he obtained incomplete, symptomatic relief.

At the time of presentation his barium radiograph showed a sliding hiatus hernia which was irreducible in the upright position. A short peptic stricture was clearly seen (Fig I). At esophagastroscope some linear ulcerations, typical of peptic esophagitis, were seen in the distal squamous epithelium just proximal to an irregular squamocolumnar junction. There was a short segment of acquired columnar esophagus (Fig II). The concentric stricture would not allow passage of the video gastroscope. The stricture was dilated by indirect passage of a 50F Maloney bougie and the endoscopy continued. The stricture lay at 33 cm from the upper teeth and the anatomic esophagogastric junction was located at 35 cm. The diaphragmatic hiatus was grossly enlarged and was identified at 41 cm from the upper teeth. The stomach, pylorus, and proximal duodenum beyond were normal.

Figure I Contrast barium radiograph of a moderate-sized, sliding hiatus hernia with a short stricture at the esophagogastric junction. The hernia was not reducible with the patient in the upright position, consistent with the suspicion of significant acquired short esophagus.
THE COLLIS-BELSEY PROCEDURE

SURGICAL TECHNIQUE

The patient is positioned for a full posterolateral thoracotomy. The operating table can be angulated or “broken” at its midpoint, which elevates the left hemithorax for improved exposure. The operating table is tilted in the reverse Trendelenburg position, which allows the abdominal content to fall away from the left hemidiaphragm and improves exposure.

Exposure is obtained with a left posterolateral thoracotomy through the sixth intercostal space. The anterior end of the incision is carried almost to the left costal margin so that it ends within a few centimeters of the diaphragmatic origin.

This provides optimal exposure for subsequent dissection at the diaphragmatic hiatus and for application of the gastrointestinal anastomosis stapler when the gastric tube is constructed.

Esophageal manometry was done. The lower esophageal sphincter was of very low tone or pressure (6 mm Hg). Furthermore, the amplitude of peristaltic contractions in the distal half of the thoracic esophagus was markedly diminished. Both of these findings are considered features that are seen secondary to intramural inflammation and scarring in the distal esophagus. The distance between the top of the lower esophageal sphincter and the top of the upper esophageal sphincter was 17 cm. The patient was 6'1” in height and 185 lb in weight, and this distance is well below the norm for a patient of this height and weight.

All of the features described above indicate significant esophageal shortening: an irreducible hernia in the barium radiograph, a high position of the esophagogastric junction at endoscopy, a diminished amplitude of peristalsis in the thoracic esophagus at manometry, and an abnormally short distance between the lower and upper sphincters at manometry.

The patient was advised that this condition was relatively benign and that he could continue with medical therapy management without serious prejudice to his health or longevity. On the other hand, it was pointed out that improvement in his current symptoms and freedom from the need for his present medication was only likely to be achieved by antireflux surgery. The patient opted for surgical treatment.

Split lung ventilation is desirable so that the left lung can be collapsed during the operation. This may be accomplished with either a double-lumen tube or a bronchial blocker.

The ribs are spread as gently as possible and are not separated more than 5 to 7 cm in order to minimize incisional pain.

The inferior pulmonary ligament is divided, the left lung collapsed or retracted anterosuperiorly, and the esophagus clearly exposed in the posterior mediastinum anterior to the aorta and lateral to the pericardium.
The esophagus is then mobilized circumferentially from the inferior pulmonary vein above to the diaphragmatic hiatus below. During mobilization both vagus nerves are palpated, identified, and carried with the esophagus. The right vagus nerve lies just to the right of the anterior border of the descending aorta as seen here at the tip of the surgeon’s index finger as it encircles the distal esophagus. The nerve is easily separated from the mobilized esophagus unless the surgeon deliberately seeks it and includes it in the mobilization. During mobilization, the mediastinal pleura over the right lung is visualised, and the surgeon takes care to avoid opening it. The right mediastinal pleura is displaced by blunt dissection from the margins of the diaphragmatic hiatus below and from the right wall of the esophagus behind the pulmonary hilum.

The mobilized esophagus with both vagus nerves is then elevated and placed on tension with a Penrose drain. As shown here, mobilization should be complete from the pulmonary hilum to the diaphragmatic hiatus below. In this photograph the hiatal margins at the diaphragm have been freed circumferentially, and the gastric fundus is drawn up into the left hemithorax and held with a Babcock clamp.

With the hiatal margins freed circumferentially, the anterior peritoneal sac of the hernia is opened into the greater sac of the peritoneal cavity. The lesser sac is opened posteriorly. The upper end of the gastrohepatic omentum, which often contains a sizeable artery, is identified and divided between clamps. Division of this part of the lesser omentum allows the entire cardia of the stomach to rise freely into the left hemithorax. Mobilization of the greater curvature side of the stomach does not require division of any short gastric vessels.
6 There is always a collection of fat between the upper and lower limbs of the phrenesophageal membrane, which envelops the esophagogastric junction. Here this fat pad has been partially freed from the anterior and left lateral aspect of the esophagogastric junction.

7 This fat pad is meticulously dissected from most of the circumference of the esophagogastric junction. During dissection, the left vagus nerve is elevated from the muscular wall of the esophagus and carried with the fat pad.

(A) The left vagus nerve is seen being separated from the anterior wall of the esophagus and carried in the fat pad. (B) The fat pad has been removed and the left vagus nerve has been displaced posteriorly and lies close to the right vagus nerve at this point in the operation.

Fat is cleared from the entire anterior surface of the esophagogastric junction and the adjacent lesser curvature side of the stomach. This dissection is tedious and requires precise coagulation, or ligation, of the many small vessels between the fat pad and the stomach. The technique is similar to that used during highly selective vagotomy.

8 The left vagus nerve is displayed in this intraoperative photograph. It has been freed from the esophagogastric junction and is seen traversing the mobilized fat pad on the anterior aspect of the esophagus and esophagogastric junction. Removal of the fat pad makes it possible to construct the gastric tube through an area of stomach that is free of any fatty covering. Removal of this fat pad is a part of the technique of a standard Belsey Mark IV repair. However, clearance of a greater circumference of esophagogastric junction is required if gastroplasty is to be added to the repair.
At this stage, a 48F Maloney dilator is passed through the mouth by the anesthetist. The bougie is advanced so that the distal end lies well within the stomach (Fig 10). In most instances, a gastric tube 4 to 5 cm in length will be sufficient to obviate unwanted tension of the repair. The objective is to create a gastric tube of uniform diameter, from top to bottom, over the indwelling 48F bougie. The proposed gastroplasty tube will be created along the dotted line.

The stomach is divided with a gastrointestinal anastomosis stapler.
11 The margins of the newly created gastric tube are reinforced and oversewn with a running suture of 3-0 chromic catgut. On the esophageal side of the gastroplasty, the staple line is oversewn, but not inverted, to ensure maintenance of the luminal diameter created by the indwelling, 48F Maloney bougie. The gastric side of the suture line is inverted with a running chromic catgut suture, which will bury the “dog-ear” stomach at the distal end of the gastric suture line.

12 A 270° (Belsey type) fundoplication is now done with three tiers of 3-0 silk sutures placed in mattress fashion using double-ended needles. Each tier is spaced approximately 1.5 cm apart, which creates a fundoplication that is approximately 4.5 cm in length. The first tier of fundoplicating sutures is illustrated as are sutures in the diaphragm for crural closure which remain untied at this time. Sutures are placed in the identical manner as for a Belsey Mark IV repair. In a Belsey repair, however, only two tiers of fundoplicating sutures are used, and a shorter fundoplication is done.

13 The placement of the sutures for the posterior crural closure are detailed here. Interrupted sutures of #1 silk are placed as illustrated. The sutures in the right limb of the crus are more widely spaced than those in the left limb, and the most anterior of these crural sutures on the right side should include a margin of the stout, tendonous diaphragmatic band that is found at the anterior end of the right crus.
A spoon is placed through the anterior aspect of the hiatus to facilitate passage of the last tier of fundoplicating sutures. These sutures are directed through the hiatus to the abdominal side and then passed through the diaphragm and brought out on the thoracic side. Both ends of the fundoplicating sutures on the right side have been passed in this fashion but not tied. This suture is passed through the diaphragm just to the right side of the anterior “apex” of the hiatus. The middle suture is in the process of placement just to the left of the apex of the hiatus, and the third suture has yet to be passed. These three sutures are separated along the diaphragmatic margin by the same distances that separate them on the circumference of the gastric tube or esophageal wall.

When the last tier of fundoplicating sutures is pulled taut, the entire fundoplication is reduced below the diaphragm. When the sutures are tied, a length of esophagus (gastric tube) of approximately 5 cm in length is secured in the abdomen below the hiatus. No tension is created on the intrathoracic esophagus or repair.
The final step in repair is closure of the diaphragmatic hiatus posteriorly. The hiatus is not closed tightly and should allow passage of the index finger alongside the esophagus and through the hiatus, without an undue sense of constriction. In this photograph the esophagus is displaced with the penrose drain, and a hemostat through the hiatus in front of the most anterior suture illustrates this loose closure. The pleural space is drained with a single 28F intercostal tube, and the incision is closed.

COMMENTS

Perioperative and Postoperative Care

Prophylactic antibiotics are given preoperatively. One gram of Ancef is administered intravenously at the time of induction of anesthesia, and a second dose is given in the recovery room approximately 4 hours later. The intercostal tube is attached to suction drainage and can usually be removed after 24 hours. Nasogastric suction is not used. Ileus has proved to be a very rare complication of this repair.

Clear fluids are usually commenced within 24 hours, and if they are well tolerated, the patient’s intake is rapidly advanced to a solid diet. Most patients manage a soft diet at the time of discharge, about the 5th postoperative day.

Follow-up

When possible, and within the limits of cost and geography, the patient is followed up for the rest of his or her life. Our protocol consists of an early visit at about 6 weeks after operation. The patient is then seen at annual intervals for the next 5 years and every 2 years thereafter as long as they are able and willing to comply. Visits consist of a personal interview by the surgical staff or resident with completion of a standard questionnaire and an appropriate examination including a chest radiograph. A barium swallow is done to evaluate the repair at 1, 5, and 10 years. Contrast radiographs, esophageal motility, 24-hour pH studies, and endoscopy are performed during the follow-up period only for the investigation of significant symptoms.

The position of the gastric tube and repair may be identified in the subsequent or follow-up chest films by placement of small metal marking clips at the time of operation. One clip is placed at the top and another at the bottom of the gastroplasty tube. The anterior edge of the diaphragmatic hiatus is marked by 2 parallel clips. These markers are easily seen in the subsequent-
Figure III  Lateral chest radiograph illustrates the small metal clips that were placed at operation. Single clips mark the top and bottom of the gastroplasty tube. The two parallel clips mark the edge of the diaphragmatic hiatus. The position of these clips is easily seen in follow-up chest radiographs, and if the position remains unchanged, there should be no anatomic recurrence of hiatal hernia.

Figure III  Lateral chest radiograph illustrates the small metal clips that were placed at operation. Single clips mark the top and bottom of the gastroplasty tube. The two parallel clips mark the edge of the diaphragmatic hiatus. The position of these clips is easily seen in follow-up chest radiographs, and if the position remains unchanged, there should be no anatomic recurrence of hiatal hernia.

posteroanterior and lateral chest films. So long as there is no change in the position of these clips, one can assume there has been no anatomic recurrence of the hernia. A typical appearance and position of the clips in a postoperative lateral chest radiograph is shown in Fig III.