



Laparoscopic Nissen Fundoplication

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Nissen fundoplication for gastroesophageal reflux disease has been performed laparoscopically since 1991. It is a technically challenging operation requiring thorough knowledge of the anatomy of the left upper quadrant as well as advanced laparoscopic skills. An understanding of the disease, proper patient selection and meticulous technique are critical to good outcomes.

The manifestations of gastroesophageal reflux disease are protean, and include heartburn, regurgitation, chest pain, bloating, abdominal pain, nighttime cough, sore throat, throat clearing, voice changes, and multiple other symptoms. Not all these symptoms respond equally well to surgical intervention. The classic symptoms of heartburn and regurgitation have the highest likelihood of being improved or eliminated by surgery. Other symptoms such as dysphagia, cough, sore throat, and chest pain respond less reliably.

Preoperative Evaluation

Work up includes upper gastrointestinal (GI) endoscopy, upper gastrointestinal fluoroscopy, esophageal manometry, and esophageal pH testing. Upper GI endoscopy allows for examination of the esophageal mucosa and documentation of esophagitis or Barrett's esophagus with photographs and biopsies. Upper GI fluoroscopy is important for understanding the anatomy of a given patient, especially as regards the location of the gastroesophageal junction, and the presence and configuration of a hiatal hernia. Esophageal manometry helps to identify motility disorders that affect surgical decision-making. Esophageal pH testing provides objective proof of the presence of disease. It also allows for a measure of symptom correlation; the patient who has symptoms that do not correspond to episodes of reflux may not benefit symptomatically from antireflux surgery.

Factors associated with a good surgical outcome include the following: the presence of classic symptoms of heartburn and or regurgitation rather than some of the more atypical symptoms; a positive esophageal pH study with greater than 50% symptom correlation; good esophageal body strength on manometry; and either no hiatal hernia or a reducible hiatal hernia on fluoroscopy. Patients who fall outside these parameters should be approached with caution and their expectations regarding postoperative symptoms should be managed prospectively.

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Operative Technique

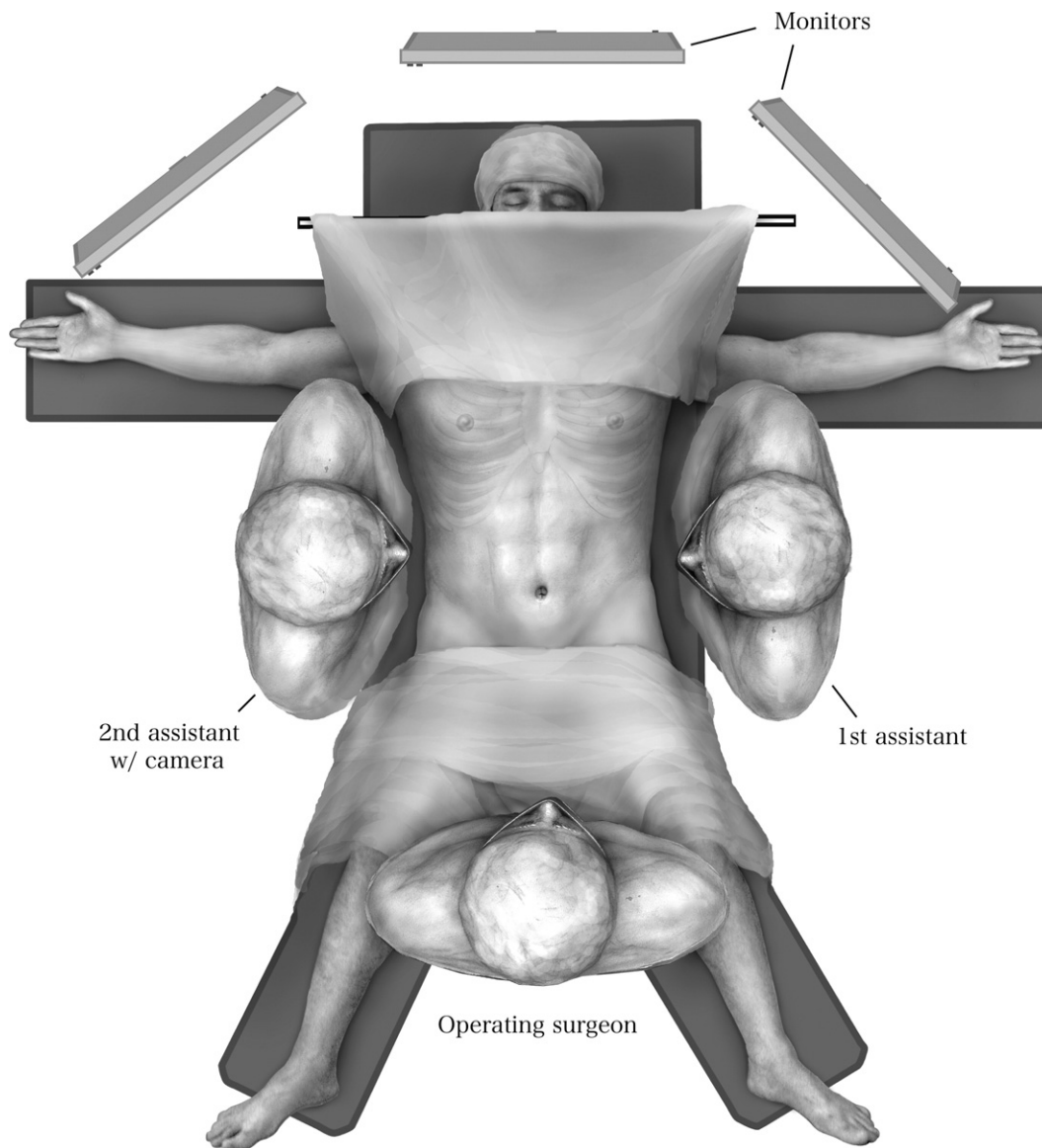


Figure 1 Room set up. The patient is positioned supine on a split leg table with arms out. Monitors are placed at eye level at the head of the table and at the patient's left shoulder. An optional third monitor is placed at the patient's right shoulder. The operating surgeon stands between the patient's legs. The camera person stands or sits to the patient's right and the first assistant on the opposite side. The table should be capable of steep reverse Trendelenberg, and should be adjusted to a height such that the surgeon can operate with shoulders relaxed and forearms parallel to the floor.

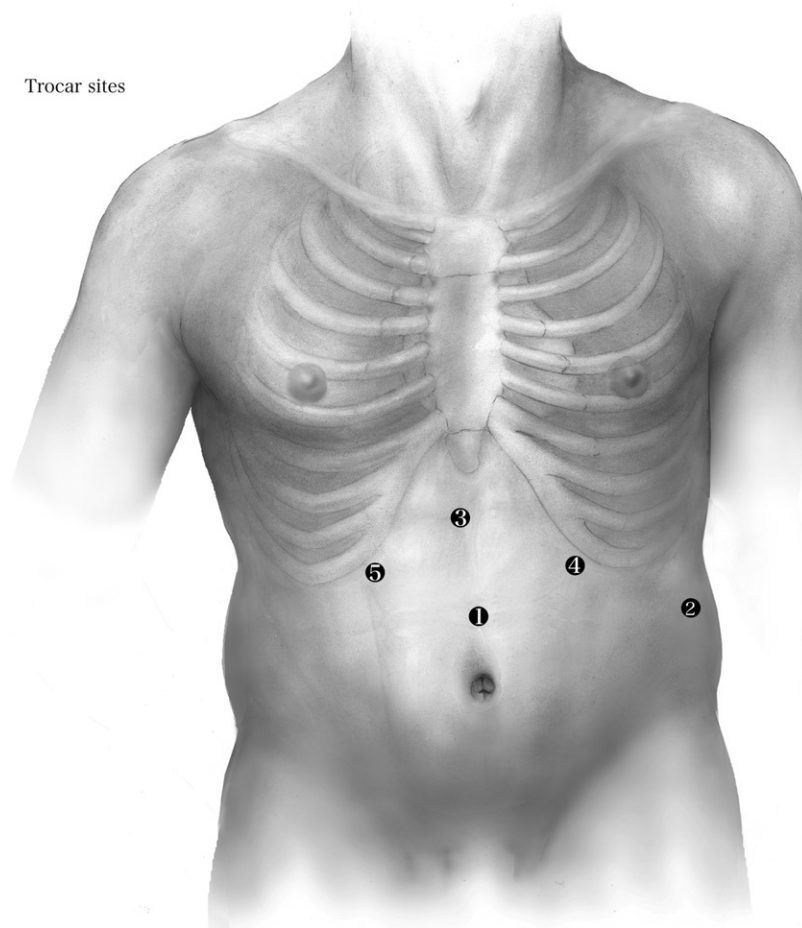


Figure 2 Trocar position. Proper trocar position is critical to the success of any laparoscopic procedure. The first 5 to 10 mm incision is made in the midline 15 cm below the base of the sternum. The abdomen is then inflated to 12 to 15 mm of Hg. The camera is then inserted to aid in the positioning of the additional ports. The second port is a 5 mm port placed at the level of the camera in the left anterior axillary line. The third port is also a 5 mm port and is placed 5 to 7 cm below the sternum at or just to the right of the midline if the patient is very small. The fourth port is a 10 mm port placed in the mid-clavicular line at a location that is 10 cm from both the second and third ports. The 10 cm distance is critical for good ergonomics during the procedure. The last port is the most flexibly located, and is a 5 mm port located on the patient's right side below the edge of the liver and comfortably away from the camera port. Ports number two and five are retracting ports, and will be used to retract the stomach and the liver, respectively. Ports three and four are working ports, and will allow for dissection and suturing instruments in the surgeon's right and left hands, respectively.

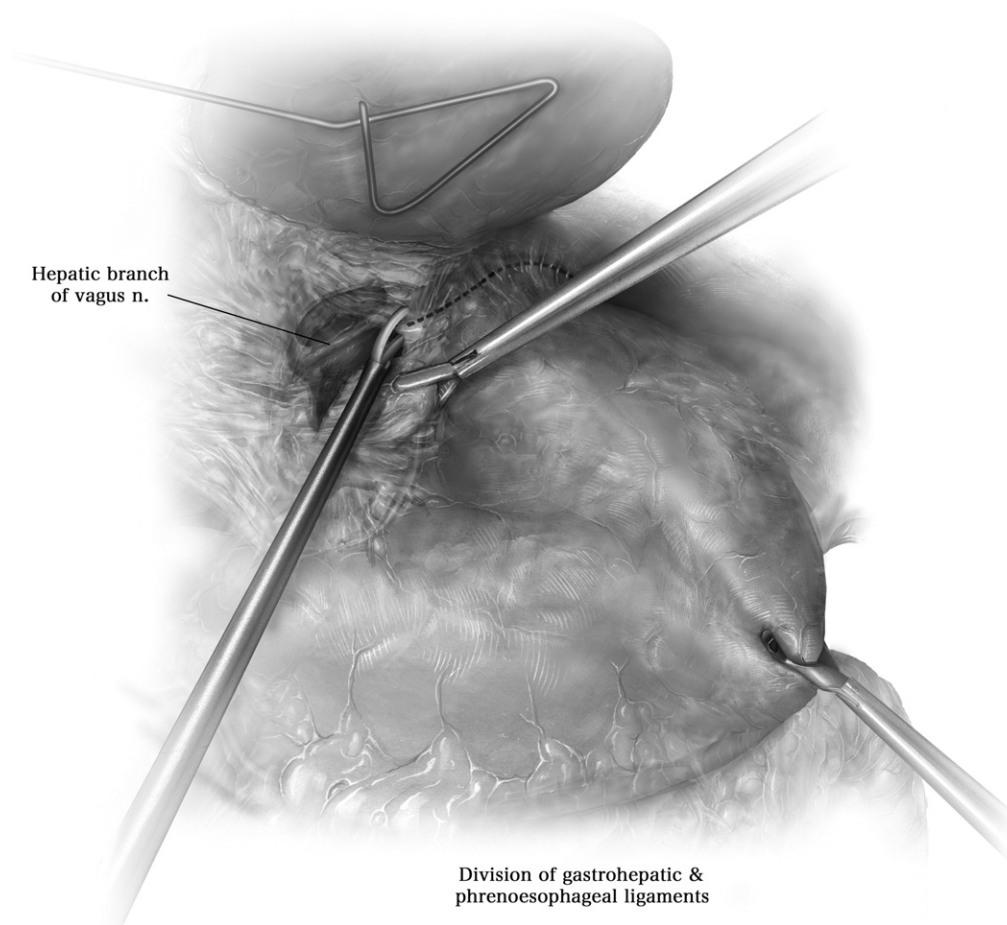


Figure 3 Exposure of the hiatus. The operation begins by elevating the left lobe of the liver anteriorly, using the fifth port for the liver retractor. The second port is used to place a grasper on the stomach, retracting it inferiorly and laterally such that tension is placed on the gastrohepatic and phrenoesophageal ligaments. An ultrasonic dissector or other cutting/sealing device is used to open the gastrohepatic ligament, exposing the retrohepatic liver as well as the right leaflet of the crus of the diaphragm. The hepatic branch of the vagus is preserved if possible, as are any aberrant or accessory vessels going to the left lobe of the liver. The phrenoesophageal ligament is likewise opened 1 to 2 cm below its insertion into the diaphragm.

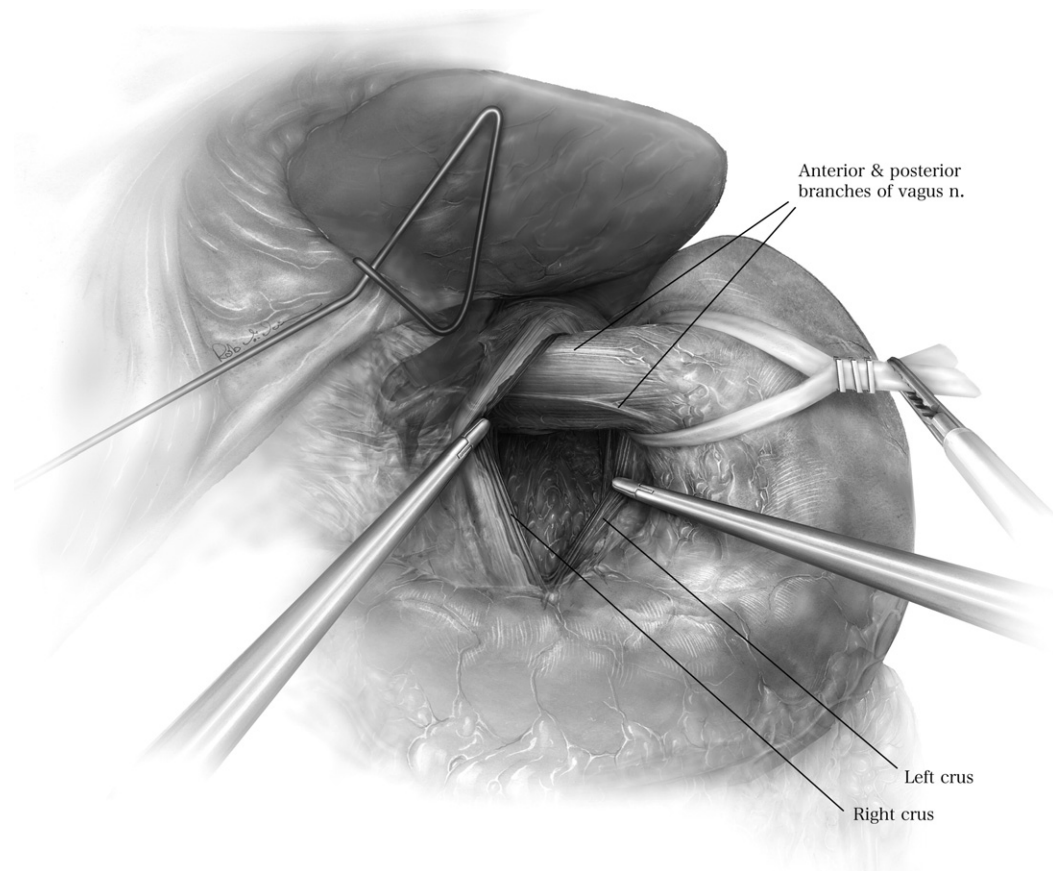


Figure 4 Encircling the esophagus. A 30 degree angled camera is used to see behind the esophagus. With the gastrohepatic and phrenoesophageal ligaments opened, the stomach is retracted anteriorly and inferiorly to open the retroesophageal space. The esophagus is safely encircled by dissection down the right leaflet of the crus of the diaphragm and identifying its junction with the left leaflet behind the esophagus. Dissection is then continued up the left side until the free space above the spleen is entered. The stomach can then be released and a Penrose drain or esophageal retractor can then be placed through the second (retracting) port to maintain control of the esophagus.

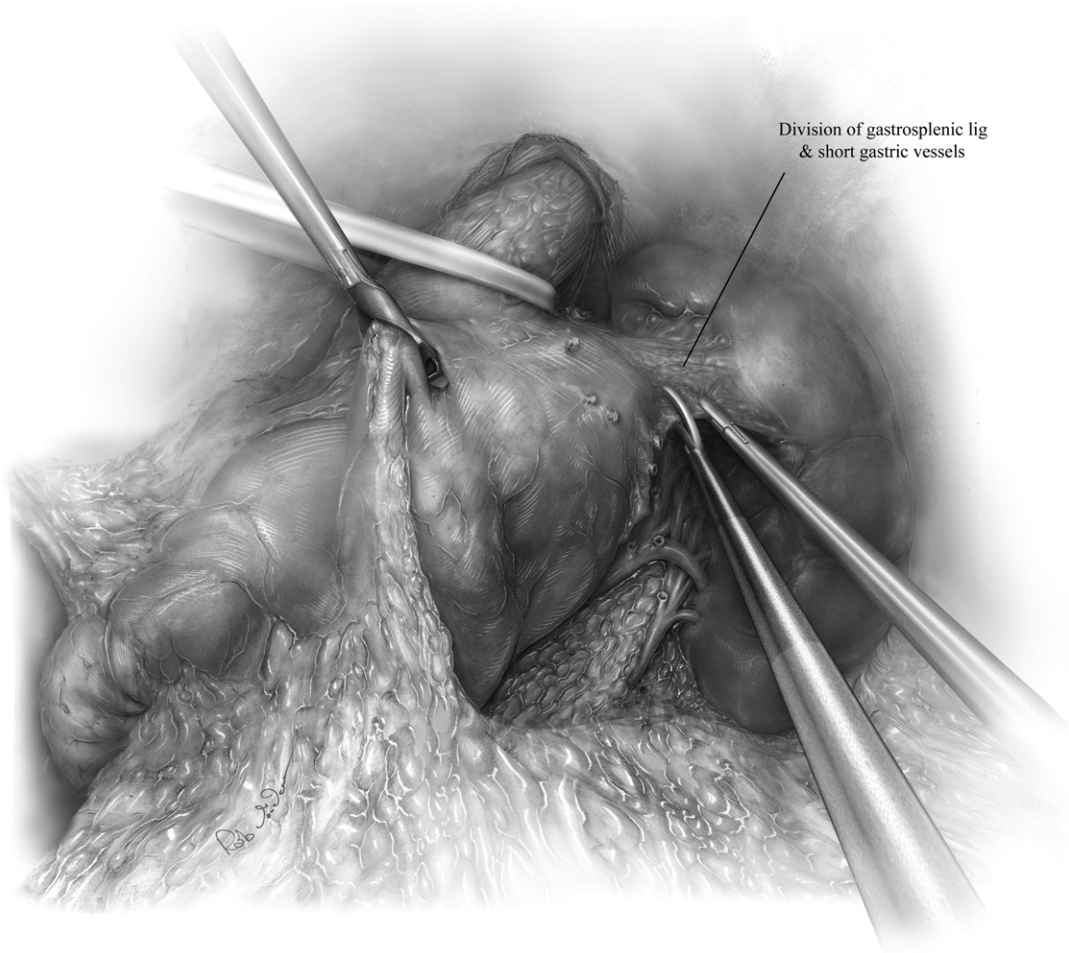


Figure 5 Division of the short gastric vessels. The stomach is grasped by the surgeon through the third port (the epigastric location) and reflected inferiorly and to the patient's right, thus exposing the greater curvature of the stomach. The gastrosplenic ligament is grasped through the second (retracting) port and lifted anteriorly and laterally. This exposes the short gastric vessels, which can be taken with an ultrasonic dissector or other cutting/sealing device. The short gastric vessels should be taken from a point about a third of the way along the greater curvature up to and including the highest short gastric vessels. Diaphragmatic and retroperitoneal attachments of the fundus should also be divided with this exposure. Care should be taken to preserve the gastroepiploic arcade.

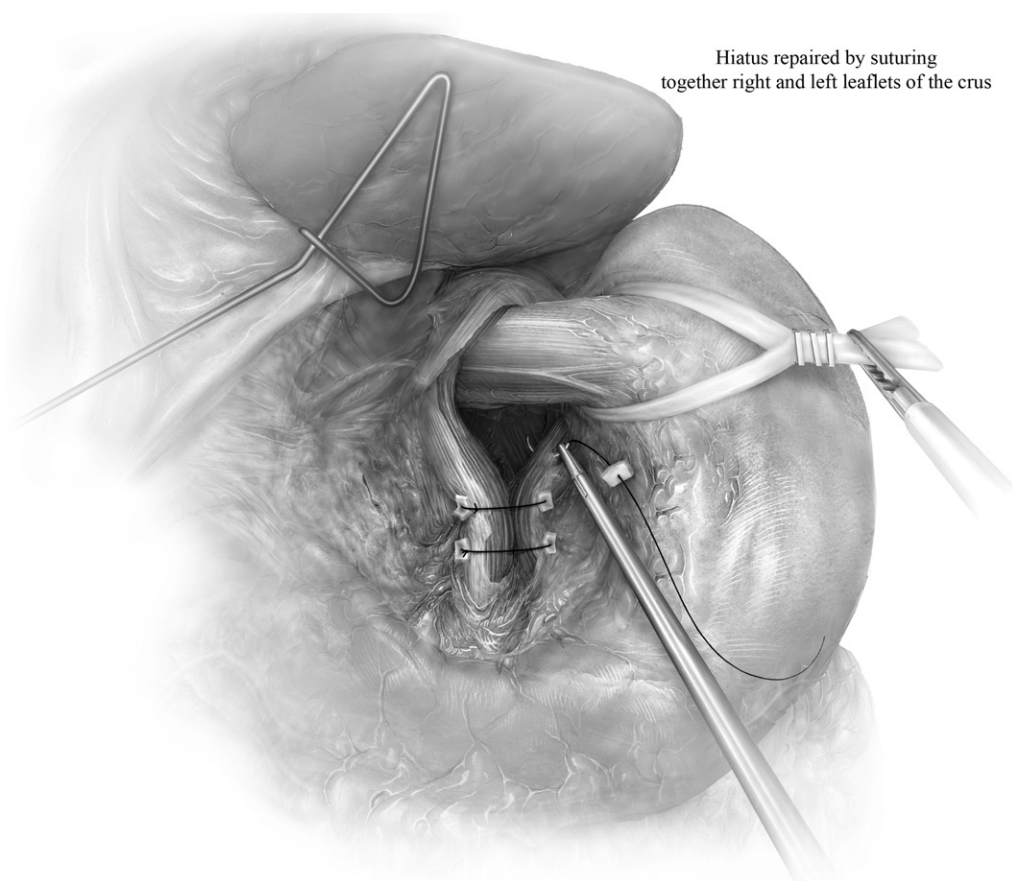


Figure 6 Repair of the hiatus. The esophagus should be retracted anteriorly, inferiorly, and laterally through the second (retracting) port. The hiatus is sutured closed posteriorly using a series of braided nonabsorbable 0 sutures. The hiatus should fit snugly around the esophagus with a 48 to 60 French bougie in place within the esophagus.

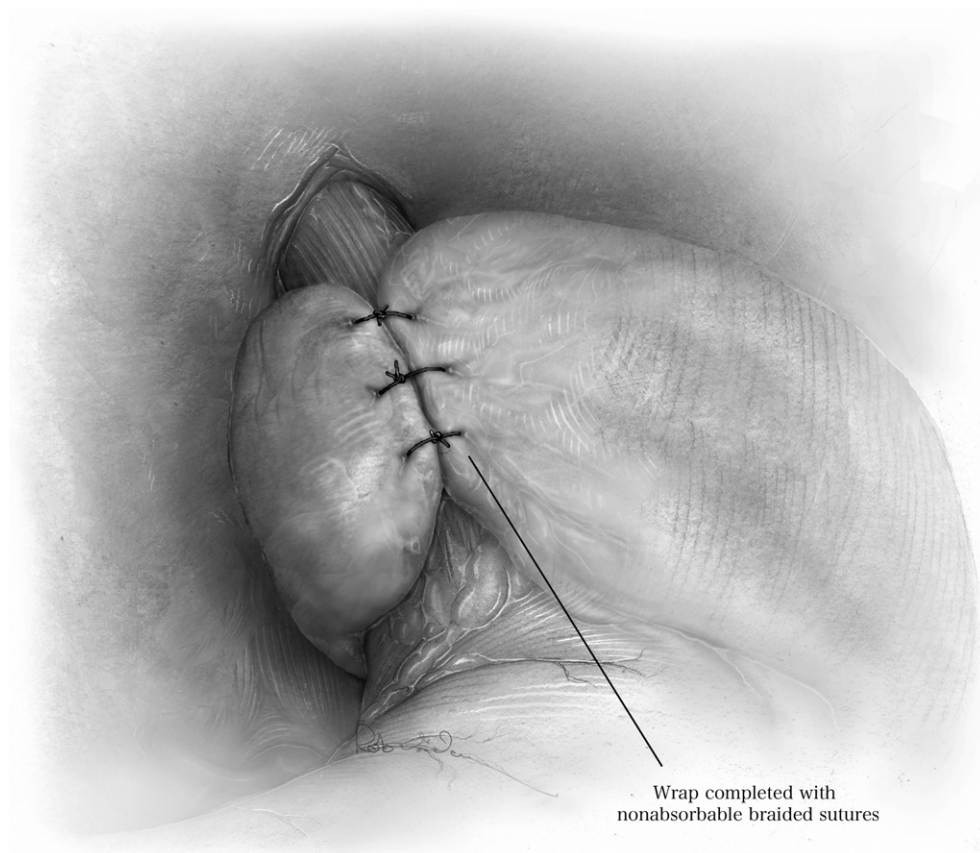


Figure 7 Forming the wrap. The fundus of the stomach is drawn posteriorly behind the esophagus. It is often useful to pull the bougie back into the esophagus to accomplish this maneuver. The bougie can then be advanced back into the stomach during formation of the wrap. The fundus should be positioned such that the short gastric vessels lie behind the esophagus. One can imagine that the esophagus is enfolded within the fundus, rather than that the fundus is slung around the esophagus. The wrap is completed with three braided nonabsorbable sutures over 1.5 to 3 cm distance along the esophagus. The vagus nerves should be incorporated within the wrap. At the conclusion of the wrap, the bougie should be withdrawn. A nasogastric tube is placed. The ports are withdrawn under direct visualization. The fascial defects for all ports larger than 5 mm are closed, and the skin is closed with subcuticular sutures.

Complications

Intraoperative complications of laparoscopic Nissen fundoplication are rare. Bleeding is usually from the short gastric vessels or spleen, and may require splenectomy. There are occasional episodes of abdominal wall bleeding from trocars, bleeding from liver lacerations from the retractor, and rarely injury to the vena cava, aorta, or left gastric vessels. Inadvertent gastrotomy or esophagotomy is also reported, but can be repaired primarily during surgery. Perforation of the esophagus by either the nasogastric tube or bougie is also a known complication.

Postoperative complications tend to be in the form of protracted or permanent symptoms. These may include gas-bloat, dysphagia, or persistent heartburn or regurgitation. The wrap may fail, come undone, or migrate down onto the stomach. The diaphragmatic repair may fail, with recurrent herniation. Injury to the vagus nerve may result in severe diarrhea and delayed gastric emptying.

The evaluation of the patient with severe early postoperative symptoms or protracted foregut symptoms postoperatively should begin with upper gastrointestinal fluoroscopy. This may identify a slipped, twisted, or unraveled wrap, or recurrent hiatal hernia. Subtle motility disorders may also be seen, as well as delays in esophageal emptying because of a tight wrap or hiatus, or delayed gastric emptying because of native dysmotility or vagus nerve injury. If the main postoperative complaint is heartburn, an esophageal pH study is mandatory to prove or exclude pathologic reflux as a cause. Although it seems intuitive that postoperative heartburn is because of reflux, very commonly this is not the case. If redo surgery is being considered, then the entire preoperative evaluation should be repeated, with the possible additions of a gastric emptying study to look for delayed gastric emptying, and a right upper quadrant ultrasound looking for cholelithiasis to complete the evaluation.

Postoperative Management

The patient is admitted overnight after surgery. The author uses a nasogastric tube to decompress the stomach and minimize postoperative nausea and vomiting. Liberal antiemetics are prescribed. Acid suppression is discontinued. No routine studies are performed the first postoperative day; specifically, we do not order routine blood tests, chest X-ray, or upper gastrointestinal fluoroscopy. The patient is offered a clear

liquid tray followed by a mechanical soft diet, and is discharged home when tolerating oral intake and oral pain medication. Patients are seen in the office at 2 weeks and again at 6 weeks. When patients are tolerating a mechanical soft diet with minimal or no dysphagia, we liberalize their diet with instructions to take small bites and chew things well.

We recommend over the counter antidiarrheal medication, topical antacids, and over the counter gas-reducing medications in the first 2 weeks after surgery to help manage the common early complaints of frequent loose bowel movements, mild heartburn, or gas-bloat. Patients should be counseled that frequent need for any of these medications, or failure to control their symptoms by these means should prompt a phone call.

We continue to see patients annually for 5 years after their surgery. Early in our experience we obtained 24 hour pH studies at 3 months and then at 1 year to objectively evaluate our outcomes during the learning curve. Barium swallows are obtained annually in patients presenting with a large hiatal hernia to evaluate for asymptomatic recurrence. Foregut complaints are promptly investigated, usually by beginning with upper gastrointestinal fluoroscopy and perhaps esophageal pH testing. We ask them not to start acid suppression medications without first discussing with us, because all too frequently the response to any sort of epigastric distress is to blame recurrent reflux without a thorough investigation.

The vast majority of patients do well over time, with a greater than 90% success rate in improving or eliminating heartburn and regurgitation. Fewer than 2% of patients have distressing enough symptoms to require additional procedures. In reflux surgery, the devil is in the detail. Proper technique, good preoperative counseling, and well-selected patients should yield excellent results.

Suggested Reading

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