Technical Aspects for Laparoscopic Nissen Fundoplication

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Laparoscopic Nissen fundoplication is indicated in patients with documented gastroesophageal reflux disease who are refractory to maximal medical therapy or who develop a complication of reflux.[1] The laparoscopic approach is a technically demanding procedure which requires extensive two handed tissue dissection and advanced suturing and knotting skills.[2,3] Our experience with over 400 laparoscopic antireflux procedures over the last three years has highlighted several technical aspects which facilitate the procedure.[4]

The patient is admitted on the morning of surgery and given 2 g of Mefoxin preoperatively. The patient is placed in the supine position under general anesthesia. The surgeon stands to the right and trocars are inserted as shown in Figure 1. Six trocars are routinely utilized with one 10-mm and five 5-mm ports. The 10-mm port is utilized for the camera and is placed 15 cm below the xiphoid process to the left of the midline so it will pass through the medial rectus sheath. We do not insufflate prior to trocar insertion. A 10-mm transverse incision is made in the skin, and an Endopath Optiview (Ethicon Endo-Surgery, Inc.) optical trocar with the 10-mm 0° videoscope is inserted under direct visualization. The optical trocar allows each fascial layer to be identified as it is penetrated. Any vessels or adherent bowel can be visualized before injury. The assistant lifts up on the abdominal wall as the surgeon utilizes a twisting motion with gentle pressure to insert the trocar. After the posterior fascia is penetrated, the videoscopic lens is retracted approximately 2 in, and insufflation is begun. The peritoneal space can then be visualized and inflated to 15 mm Hg before inserting the remaining trocars. The 10-mm, 0° lens is used for the remaining trocar insertions. The 5-mm xiphoid trocar is utilized for liver retraction by placing a grasping, locking alligator forceps on the hiatus at 12 o'clock. The triangular ligament to the left lobe of the liver is not divided as it aids in retraction. This technique of liver

retraction is less traumatic, requires no assistant to hold, and works well even in cases of hepatomegaly.[3] The surgeon and assistant each insert two 5-mm trocars, so that each can operate with two hands. Allowing the assistant to utilize both hands greatly aids in exposure and speeds the operation.

After insertion of the six trocars, a 10-mm, 45° lens is substituted for the 0° videoscope. The 45° scope is ideal for looking behind the esophagus during mobilization and for exposing the short gastric vessels at the apex of the fundus.

For instrumentation, we utilize standard grasping forceps, a 45-cm suction-irrigation probe with monopolar cautery, laparoscopic needle drivers (Wiltek), scissors, and a 45-cm bipolar forceps (Everest Medical, Inc.). At least two grasping forceps and one needle driver need to be 45 cm in length to reach the operative site from the lower trocars. A high flow insufflator (Snowden-Pencer) is mandatory to allow frequent suctioning to clear smoke during cautery usage.

The dissection begins on the left of the hiatus at the angle of HIS (Fig. 2). The assistant grasps the fundus and retracts downward and lateral. The surgeon utilizes the suction cautery to divide the peritoneal attachments along the left crus from the diaphragm to the gastroesophageal junction. This greatly facilitates the posterior esophageal mobilization from the right side.

With the assistant maintaining traction down on the fundus, the surgeon moves to the right of the hiatus and divides the lesser omentum over the caudate lobe. We do not routinely save the hepatic branch of the vagus nerve, but great care must be taken to identify any vessels in the lesser omentum. In approximately 10% of patients, a large branch of the left hepatic artery will transverse this area and should be preserved. The right crus is identified, and the peritoneum along its anterior border is divided (Fig. 3). The dissection must stay medial along the crus border to avoid vena cava injury. The dissection begins at 11 o'clock and proceeds inferior until the median arcuate ligament is identified and the base of the left crus is seen. The dissection is then carried up along the lateral border of the left crus dissecting bluntly until the posterior window is opened. The posterior vagus is seen adjacent to the esophagus and will usually stay with it during the mobilization. Turning the

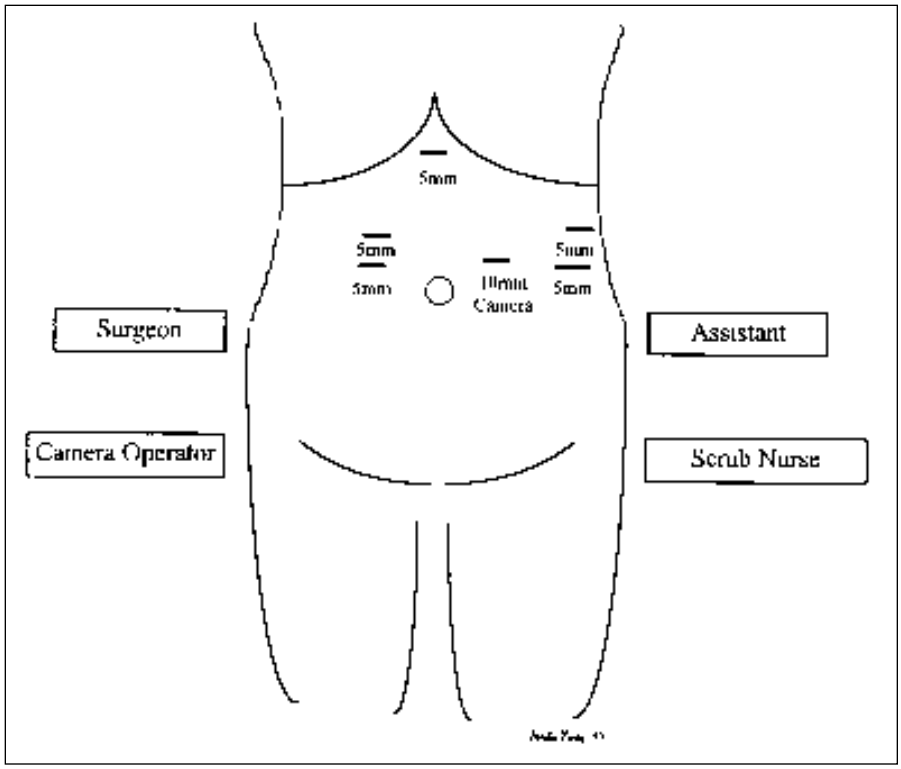


Figure 1. Operating room set-up for Nissen fundoplication.

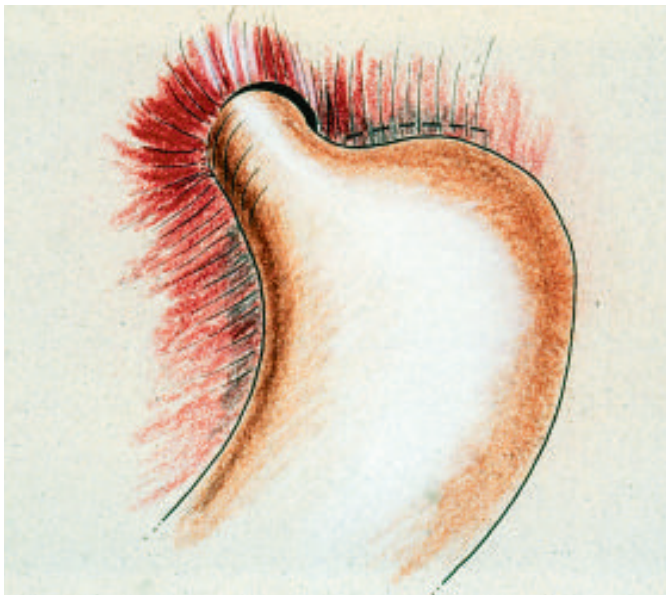


Figure 2. Dissection begins on left at angle of HIS.

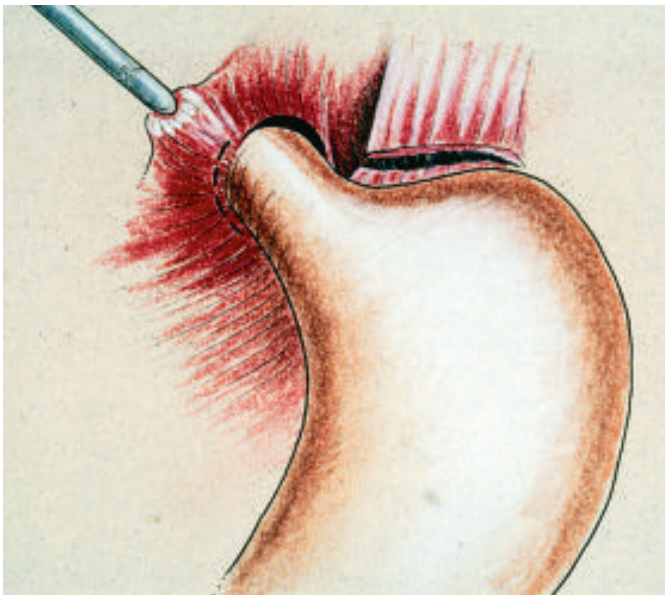


Figure 3. Division of peritoneum along right crus.

45° scope laterally provides excellent visualization of the dissection (Fig. 4). A blue vessel loop is passed around the esophagus for traction and is secured with a chromic Endoloop ligature (Ethicon, Inc.). The Endoloop ligature is more secure than metal clips and will pass through a 5-mm trocar. The assistant then retracts the esophagus downward with the loop, and the surgeon completes the crura dissection superiorly over the anterior esophagus from 11 o'clock to 2 o'clock, taking care to identify and preserve the anterior vagus nerve. At this point the crura borders have been dissected allowing the esophagus to fall away. This decreases the risk of esophageal perforation by avoiding dissection on top of the esophagus. The dissection of the esophagus is done with only a nasogastric tube in place, since the perforation rate is higher if a bougie is in place during the mobilization.

The next step is to divide the short gastric vessels along the upper one-third of the greater curvature and fundus. The routine division of the short gastrics ensures a loose, floppy fundus in which to complete the wrap. Although metal clips and the harmonic scalpel have been successful, we prefer utilizing a bipolar forceps for homeostasis. It is rapid, passes through a 5-mm trocar, and we have had no bleeding complications in over 200 fundoplication cases.[4] There is a special technique that is most effective with the bipolar forceps. The forceps must be opened and closed several times to "weld" the tissue and prevent sticking. The forceps "weld" better when the jaws are slightly opened. A 5-mm coagulum is created and then divided with scissors. If bleeding occurs after transection, the vessel is easily regrasped and re-cauterized with the forceps, as opposed to reapplying metal clips which can be awkward. The fundus is passed posterior to the esophagus to ensure adequate mobilization. A 50-French bougie is passed into the stomach and the wrap should be loose enough for the two sides to overlap. This technique avoids a 60-French bougie which in our experience can be difficult to introduce.

The fundus is reduced and the crura are exposed by retracting the esophagus to the left. We routinely tighten the hiatus by approximating the crura loosely around the 50-French bougie. We utilize one or two 0-Ethibond Extra sutures (Ethicon, Inc.) with an extracorporeal technique (Fig. 5). Care must be taken not to close the crura too tightly or an artificial valve can be creat-

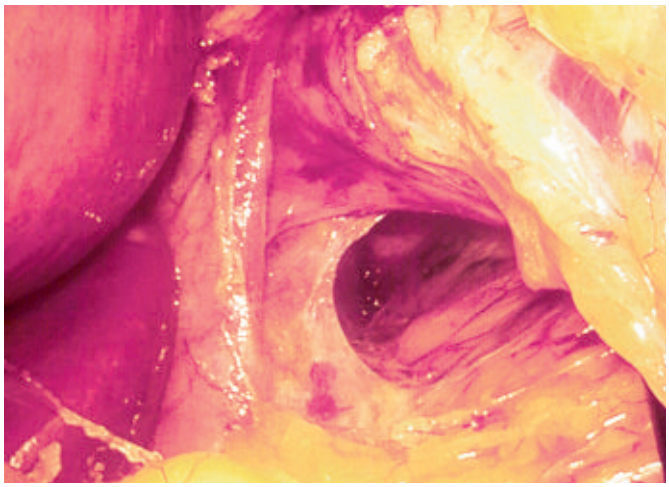
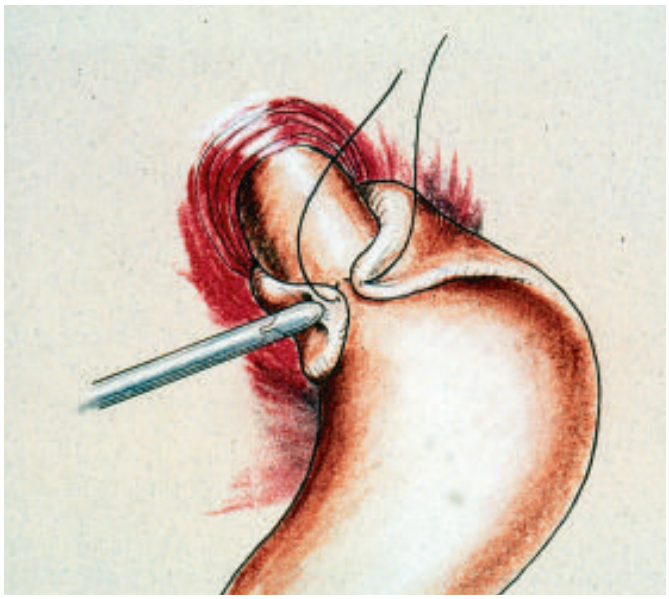


Figure 4. Posterior view behind esophagus with 45° telescope.

Figure 5. Crural closure with extracorporeal suture.



Figures 6a (left), 6b (right). Completed suture wrap for Nissen fundoplication.

Figure 6b.

ed above the wrap. Note that the Endoknot sutures need to be inserted through the left subcostal trocar to ensure the knot pusher will be long enough to tighten the suture.

After crural closure, the fundus is again passed posterior around the esophagus, taking care not to twist the stomach. The fundoplication is then performed utilizing 0-Ethibond Extra Endoknot sutures (Ethicon, Inc.) with an extracorporeal technique. Normally only two sutures are utilized (Fig. 6). The first is placed 2 cm above the GE junction and incorporates large full thickness bites of stomach and esophagus. The second suture is placed at the level of the GE junction, again through stomach and esophagus. This ensures a short wrap. The wrap needs to be less than 2.5 cm in length, since the wrap effectiveness is also a function of length. Too long a wrap will result in increased gas bloat syndrome. We do not utilize pledgets in our suturing on fundoplications.

After completing the wrap, we anchor it to the crura at 10 o'clock and 2 o'clock with 0-Ethibond Extra sutures tied extracorporeally to prevent wrap slippage. This also brings the crura valve mechanism in contact with the wrap, which may decrease dysphagia and gas bloat. The abdomen is irrigated and inspected for bleeding. The liver retraction is removed, and 30 cc of 0.25% marcaine are instilled intraperitoneally. The 10-mm trocar site fascia is closed with 2-0 Vicryl sutures, and the skin is closed with 4-0 Monocryl sutures (Ethicon, Inc.).

Postoperatively the nasogastric tube is removed and clear liquids begun four hours later. A mechanical soft diet is initiated on postoperative day 1, and most patients are discharged with a prescription of a mild analgesic. They resume normal activity when they desire and are seen for postoperative visits at one and four weeks. A regular diet is resumed on week 3 before their last visit. They are then discharged to their physician for care as needed. STI

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