

# GENERAL SURGERY

## 101: NISSEN

### FUNDOPLICATION

Kelley Yuan, Class of 2023

Tyler Bauer, Class of 2020

The first time that medical students enter the OR can be a jarring experience. Successfully maintaining sterility is hard enough, but remembering relevant patient history, answering “pimp” questions, and performing basic suturing skills can make the third year medical student experience difficult. In this article we describe a common surgery performed by both general and thoracic surgeons with a specific focus on “medical student level” understanding. This piece is the product of a collaboration between an MS1 and MS4, both of whom are interested in a career in surgery. We hope you find it helpful!

#### SYNOPSIS

The Nissen fundoplication, routinely performed laparoscopically, is a procedure indicated to treat gastroesophageal reflux disease (GERD) and hiatal hernias. In short, the surgeon intends to buttress the lower esophageal sphincter (LES) in order to stop gastric reflux into the esophagus. This will decrease the “heartburn” symptoms that the patient feels and lower the chance of developing dysplasia of the esophageal mucosa. In order to tighten the LES, the gastric fundus is wrapped around the base of the esophagus and sutured in place. The extra tissue that this maneuver adds to the lower esophagus also prevents the stomach from sliding upward through the diaphragm hiatus.

#### INDICATIONS

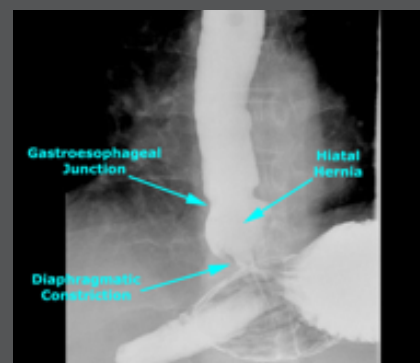
In patients with type I-IV paraesophageal hiatal hernias, Nissen fundoplication is the first line procedure. In patients with refractory GERD, it is usually done after medical treatment has failed. Symptoms of refractory GERD can include frequent heartburn, severe esophagitis, esophageal ulceration, recurrent strictures, and esophageal dysplasia (Barrett’s esophagus). To qualify for this surgery, patients must have at least some preserved motility and a normal length esophagus. If motility is very diminished, partial fundoplication should be considered.

#### MECHANISM OF RELIEF

Fundus reinforcement of the lower esophageal sphincter has two effects. Stomach wall contraction helps close the sphincter to reduce acid reflux. The additional mass of the gastric wrap reduces the risk of recurrent hiatal hernia by producing a plug less prone to slipping through the opening of the diaphragm.

#### DIAGNOSTIC STUDIES

Esophagogastroduodenoscopy (EGD) is mandatory. Other studies include esophageal manometry, barium swallow, and pH monitoring.

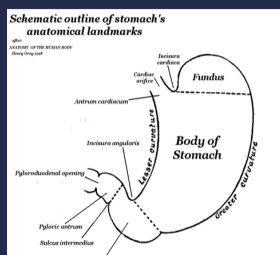
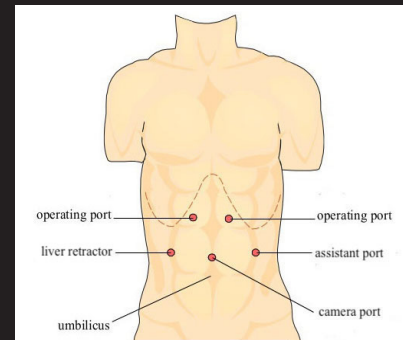


In a barium swallow (pictured), the patient is asked to swallow a radio-opaque dye. At the time the patient is swallowing, an x-ray is taken, so the inside of the esophagus can be visualized. This is useful for diagnosing many esophageal pathologies. In the case of a sliding hiatal hernia, the gastroesophageal junction (GEJ) can be visualized above the diaphragmatic constriction. In a patient without a sliding hiatal hernia, the GEJ and diaphragmatic constriction would be in the same location.

# THE OPERATION

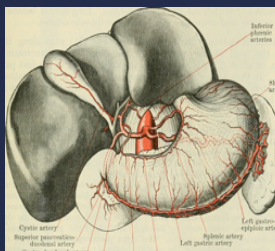
## 1. PORT PLACEMENT

The patient is induced under general anesthesia and secured to the table. The patient then is placed in reverse Trendelenburg position with the hips flexed. The surgeon uses an insufflator to inflate the abdomen with carbon dioxide, which helps to visualize the surgical field. A periumbilical incision is then made to establish the camera port. The other 4 ports are then placed to face toward the GEJ. Depending on the level of expertise of the medical student, the student may “drive” (hold and position) the camera during the case.



## 2. MOBILIZING THE FUNDUS

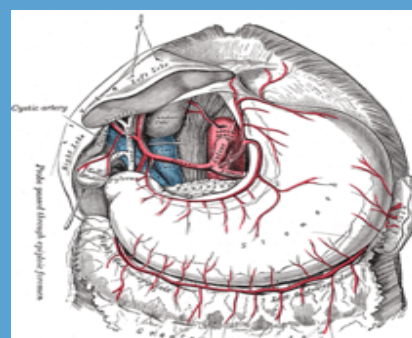
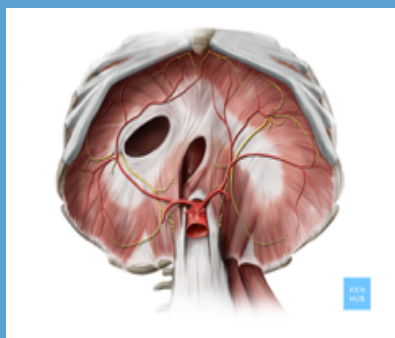
First, the surgeon must free the fundus of the stomach in order to provide the tissue that will ultimately be wrapped around the esophagus. In order to do this the surgeon must divide the gastrosplenic ligament, which contains the short gastric arteries. In order to visualize the anterior stomach, a liver retractor is used to retract the left lobe of the liver. The gastrosplenic ligament is identified. Using a grasper to hold the fundus of the stomach, and another grasper to provide counter-tension, the ligament is divided using a cautery device. The division of the gastrosplenic ligament and any other lateral attachments mobilizes the fundus for easy handling.



## 3. DISSECTING THE HIATUS

Dissecting the hiatus allows the surgeon to assess any potential hernia and expose the GEJ. At the left crus, the left gastrophrenic ligament is opened to expose where the left crus meets the right crus. After retracting the stomach laterally, the lesser sac is split to reveal the right crus.

Care is taken to avoid injuring the left gastric artery, a possible replaced hepatic artery, and the anteroposterior branches of the vagus nerve.



#### 4. MOBILIZING THE FAT PAD AND ASSESSING ESOPHAGEAL LENGTH

After dissecting the hiatus, the surgeon will be able to identify a fat pad on the anterior esophagus. The fat pad reliably demarcates the GEJ. Using a grasper, the surgeon can confirm the location of the GEJ by identifying an oblique border where the longitudinal esophageal muscle meets gastric sling muscle (they run perpendicular to each other). Mobilizing the fat pad is a highly important step; failure to accurately isolate the GEJ often results in a mis-estimation of the GEJ location and a consequently weaker fundoplication.

Gastric wrapping around a short esophagus may place extra tension on the hiatus and can reopen the hernia. Furthermore, leaving extra tension on the esophagus can be a cause for a “slipped Nissen” where the fundus is wrapped around the cardia of the stomach, rather than around the esophagus. If the patient has a short esophagus (incidence 10%), the surgeon can perform a Collis gastroplasty to lengthen it.

#### 5. HIATAL CLOSURE

The right and left crura are reapproximated with 3-5 sutures, with the last suture placed but not yet knotted. The surgeon introduces a bougie, a thin cylindrical tool used to explore and widen tubular organs, roughly 10 cm below the GEJ to gauge the tightness of the hiatal closure. After ensuring a snug, non-constricted fit, the surgeon retracts the bougie, then adjusts and ties the last suture.

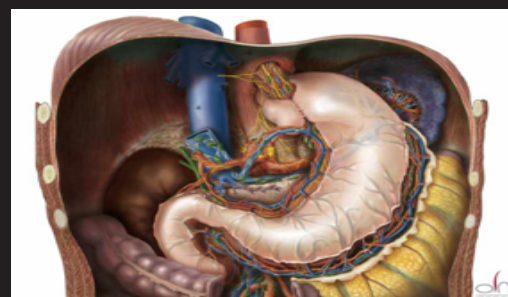
#### 6. FASHIONING AND SECURING THE WRAP

One grasper grips the most apical region of the greater curvature, pulling it underneath the esophagus and medially toward the right side. Another grasper grips the lateral stomach for stability and in preparation for the wrap. The bougie is reintroduced and the fundus is “shoeshined” around the esophagus to confirm the right tension and alignment of the wrap.



#### 7. SECURING THE FUNDOPLICATION AND CLOSING

The first two stitches to secure the fundus travel through all three tissues of stomach-esophagus-stomach. The last stitch at the base secures stomach-stomach tissue. When stitching, care is taken to penetrate the serosa and muscularis while avoiding the mucosa, since mucosal perforation can cause leakage and ensuing necrosis if knotted too tightly. The fascia and skin are then closed. The student will likely help close the port sites.



# POTENTIAL SURGICAL COMPLICATIONS

## Dysphagia

### *Causes*

Overtightened hiatal closure  
Long fundoplication wrap  
Slipped wrap

### *Prevention*

Calibrate with a bougie  
Measure the wrap  
Preoperative manometry

## Perforation

### *Types*

Esophageal perforation  
Gastric perforation

### *Prevention*

Carefully identify and avoid esophagus  
Avoid aggressive traction and assess stomach before closure

## Splenic Injury

### *Cause*

Iatrogenic trauma

### *Prevention*

Remove the splenic attachments to the stomach early  
Use gentle traction when taking the short gastrics

## ALTERNATIVE PROCEDURES

**Transoral incisionless fundoplication (TIF):** the endoscopic procedure allows the operator to staple the stomach to the esophagus through the mouth rather than through abdominal incisions.

**LINX magnetic sphincter device:** introduced in 2013, the LINX consists of a ring of magnets that encircle the outer wall of the lower esophageal sphincter and reinforce the GEJ. A food bolus can separate the components of the magnetic ring, and the reattraction of the ring components after a meal prevents acid reflux.

### REFERENCES AND FIGURE SOURCES

Lebenthal, Abraham, and Raphael Bueno. "Nissen Fundoplication." *Adult Chest Surgery, Second Edition* Eds. David J. Sugarbaker, et al. New York, NY: McGraw-Hill, 2014, <http://accesssurgery.mhmedical.com/content.aspx?bookid=1317&sectionid=72428779>.

Volik A, Joffe J, Alvarez C et al. Factors contributing to laparoscopic failure during the learning curve for laparoscopic Nissen fundoplication in a community hospital. *J Laparoendosc Adv Surg Tech A*. 1999;9:243–248.

Danaliloglu A, Cipe G, TOydemir T, Kocaman O, Ince AT, Muslumanoglu M, Senturk H. Endoscopic stapling in comparison to laparoscopic fundoplication for the treatment of gastroesophageal reflux disease. *Dig Endosc*. 2014 Jan; 26(1):37-42.

Saino G, Bonavina L, Lipham JC, Dunn D, Ganz RA. Magnetic sphincter augmentation for gastroesophageal reflux at 5 years: final results of a pilot study showing long-term acid reduction and symptom improvement. *J Laparoendosc Adv Surg Tech A*. 2015 Oct 1; 25(10): 787-792.

Kavanagh K. Gastroesophageal Reflux. 2017. [http://www.entusa.com/ge\\_reflux.htm](http://www.entusa.com/ge_reflux.htm)

Cunningham DJ, Robinson A. *Cunningham's Textbook of Anatomy*. New York: W. Wood, 1914.

Gray H. *Gray's Anatomy of Human Body*. 20th Edition. 1918.

Gray JP. Nissen Fundoplication. 2007. [https://en.wikipedia.org/wiki/Nissen\\_fundoplication#/media/File:Nissen\\_fundoplication.png](https://en.wikipedia.org/wiki/Nissen_fundoplication#/media/File:Nissen_fundoplication.png)

Hamers D. "Nissen fundoplication, cross section". 2012. [https://commons.wikimedia.org/wiki/File:Doorsnede-Nissen\\_wiki.jpg](https://commons.wikimedia.org/wiki/File:Doorsnede-Nissen_wiki.jpg)

Hamers D. "Nissen fundoplication, an operation in which the fundus is tied around the esophagus". 2012. [https://en.wikipedia.org/wiki/Nissen\\_fundoplication#/media/File:Watercolour\\_of\\_the\\_Nissen-method.jpg](https://en.wikipedia.org/wiki/Nissen_fundoplication#/media/File:Watercolour_of_the_Nissen-method.jpg)