

Review Article

Failed Fundoplication and Complications of Antireflux Surgery: Radiographic, Endoscopic and Laparoscopic Views

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Abstract

Background: Failed fundoplication and complications of antireflux surgery are challenging conditions. The ability for prompt diagnosis requires knowledge of the clinical, radiographic and endoscopic presentation. The primary care physicians, gastrointestinal radiologists and gastroenterologists play a crucial role in the management of patients with such a complex disease.

Aims: To facilitate the diagnosis and treatment of patients with failed fundoplication and complications of antireflux surgery.

Methods: First, we described the different types of laparoscopic fundoplications and presented their radiographic, endoscopic and laparoscopic features. Second, we described the different types and etiology of failed fundoplications and complications of antireflux surgery, depicted their radiographic, endoscopic and laparoscopic features, and discussed their treatment. The images presented in this article were collected from cases treated at the Esophageal Disease Center at Memorial Hermann Southeast Hospital in Houston, Texas.

Results: From 09/02/2010 to 10/26/2015, a total of 50 reoperative antireflux surgeries were performed. The radiographic, endoscopic and laparoscopic features of different types of complications, prior to reoperative surgical intervention were depicted in 12 figures.

Conclusion: The presentation of the radiographic, endoscopic and laparoscopic images depicted in this article provides a useful diagnostic reference that may facilitate diagnosis and treatment, and improve outcomes of patients with failed fundoplication and complications of antireflux surgery.

INTRODUCTION

Despite overall success, measured by great outcomes of laparoscopic hiatal hernia repair in specialized centers [1,2] failed fundoplication and complications of antireflux surgery can occur. The rate of symptomatic recurrence requiring reoperative antireflux surgery is between 2.8-3.6% [3,4] and for large paraesophageal hiatal hernia, 3.2-11% [5-7]. The aim of this review is to facilitate the diagnosis and treatment of patients with failed fundoplication and complications of antireflux surgery. Our goal is to describe different types of laparoscopic fundoplications, and their potential complications, as well as to depict their radiographic, endoscopic and laparoscopic features.

Nissen fundoplication

Nissen fundoplication is a 360-degree posterior fundoplication named after Rudolph Nissen, who, in 1956, introduced the results of "gastroplication" via an open transabdominal approach for control of gastroesophageal reflux disease (GERD) and repair of hiatal hernias [8]. Details of the steps of a laparoscopic Nissen

fundoplication have been previously described [9].

On esophagram, a Nissen fundoplication appears as an area of narrowing located below the diaphragmatic crura. The entire fundoplication should be located below the diaphragm. There should be a free passage of contrast through the gastroesophageal junction with minimal delay. On the retroflexed endoscopic view, a Nissen fundoplication appears as a triangular bulging in the gastric fundus below the diaphragmatic crura. If an adequate crural closure is performed, there should be no visible opening in the crural impression. The laparoscopic view of a Nissen fundoplication shows the 2 lips of the fundoplication sutured to the esophagus and approximated to each other. The fundoplication should be placed around an adequate, tension-free, intra-abdominal esophageal length of at least 2-3 cm. Descriptive images are shown in (Figure 1).

Toupet fundoplication

Toupet fundoplication is a 270-degree posterior partial fundoplication named after Andre Toupet, who, in 1963, introduced



Figure 1 Nissen fundoplication: 360-degree posterior fundoplication.

1A: Upright view of an esophagram showing an intact fundoplication. N: Nissen fundoplication.

1B: Retroflexed endoscopic view of an intact Nissen fundoplication.

1C: Laparoscopic view of an intact Nissen fundoplication. E: Esophagus. N: Nissen fundoplication with overlying pledgets. The fundoplication is placed around the esophagus. C: Crural closure.

the concept of partial fundoplication to improve postoperative dysphagia after Nissen fundoplication [8]. His article described a partial fundoplication for relief of reflux in patients with hiatal hernia and after Heller myotomy in patients with achalasia [10]. Details of the steps of a laparoscopic Toupet fundoplication have been previously described [7]. On esophagram, a Toupet fundoplication appears similar to a Nissen fundoplication. While patients may experience less dysphagia compared to Nissen, the radiographic difference between the two may not be visible, particularly in the perioperative period.

On the retroflexed endoscopic view, a Toupet fundoplication appears as a bulging area of the fundus with a more rounded tip compared to a Nissen. The squamocolumnar junction may be visible in the retroflexed view in both Nissen and Toupet fundoplications which confirms that the fundoplication is placed around the esophagus. The laparoscopic view of a Toupet fundoplication shows the lips of the fundoplication placed at each side between the esophagus and the stomach. Descriptive images are shown in (Figure 2).

Dor fundoplication

Dor fundoplication is a 180-degree anterior fundoplication named after J. Dor, who, in 1962, introduced the concept of partial fundoplication to control reflux in patients with esophageal dysmotility and to prevent postoperative dysphagia associated with Nissen fundoplication [8]. His article described a modified Nissen to prevent reflux in patients with achalasia after Heller myotomy [11]. The steps of a laparoscopic Dor fundoplication have been previously described [12].

On esophagram, a Dor fundoplication after Heller myotomy shows free passage of contrast with minimal delay through the gastroesophageal junction. On the retroflexed endoscopic view, a Dor fundoplication appears as an area of bulging of the fundus with a flat tip of 180 degrees. The laparoscopic view of a Dor fundoplication shows the fundus of the stomach covering anteriorly, the left lateral myotomy site. The right gastroepiploic arcade should remain at its normal anatomic position on the greater curvature of the stomach on the left side without twist in the longitudinal axis of the stomach. Descriptive images are shown in (Figure 3).

Belsey fundoplication

Belsey Mark IV repair is a 240-degree anterior fundoplication named after Ronald Belsey, who, in 1952, introduced the concept of anterior fundoplication via a transthoracic approach in order to restore the lower esophageal sphincter in patients with GERD and hiatal hernia [8]. Belsey fundoplication is performed via a left posterolateral thoracotomy through the sixth intercostal space [13]. An intact Belsey fundoplication on videoesophagram and retroflexed endoscopic view is similar to a Toupet fundoplication, as shown in (Figure 2). With advances in the techniques of laparoscopic Nissen and Toupet fundoplication, the use of Belsey fundoplication has decreased substantially.

Collis gastroplasty

Collis gastroplasty is an esophageal lengthening procedure named after J. Leigh Collis, who, in 1957, introduced the esophageal lengthening procedure in patients with irreducible hiatal hernia, esophagitis and stricture [8,14]. The details of the steps of the procedure were previously described [9]. With the use of proton pump inhibitors (PPI) for treatment of GERD, the use of Collis gastroplasty has decreased substantially. In our report of 131 patients with large hiatal hernia, tension-free, intra-abdominal esophageal length was achieved in all without the need for Collis gastroplasty [7].

On esophagram, a segment of Collis gastroplasty appears as the continuation of the esophagus, located below the gastroesophageal junction and under the crural impression. On upper endoscopy, antegrade view, a segment of Collis gastroplasty appears as a tubular structure with lining of gastric mucosa, positioned below the gastroesophageal junction and below the crural closure impression. On the retroflexed view, the segment of Collis gastroplasty will not be visible. On the laparoscopic view, the segment of the Collis gastroplasty appears as a tubular structure in continuation with the esophagus. A remnant of a wedge excision of the stomach is visible in a triangular shape. Descriptive images are shown in (Figure 4).

Herniated fundoplication

Transdiaphragmatic migration of the fundoplication and recurrent hiatal hernia are the most common patterns of failure,

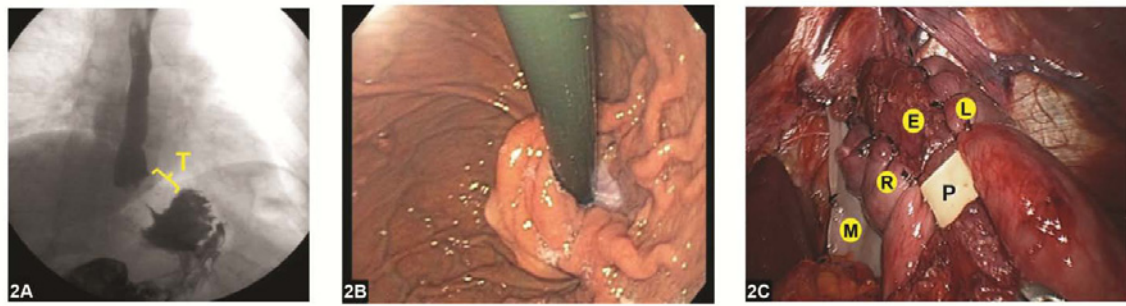


Figure 2 Toupet fundoplication: 270-degree posterior fundoplication.

2A: Upright view of an esophagram showing an intact Toupet fundoplication. T: Toupet fundoplication.

2B: Retroflexed endoscopic view of an intact Toupet fundoplication.

2C: Laparoscopic view of an intact Toupet fundoplication. E: Esophagus, R: Right lip of a Toupet fundoplication, L: Left lip of a Toupet fundoplication, M: Mesh overlying crural closure, P: Penrose drain around the gastroesophageal junction. The fundoplication is placed above the penrose drain and around the esophagus.



Figure 3 Dor fundoplication: 180-degree anterior fundoplication.

3A: Upright view of an esophagram of a patient who underwent Heller myotomy and Dor fundoplication for treatment of achalasia. E: Esophagus, D: Dor fundoplication.

3B: Retroflexed endoscopic view of an intact Dor fundoplication.

3C: Laparoscopic view of a Dor fundoplication covering the left lateral myotomy site. E: Esophagus, D: Dor fundoplication.

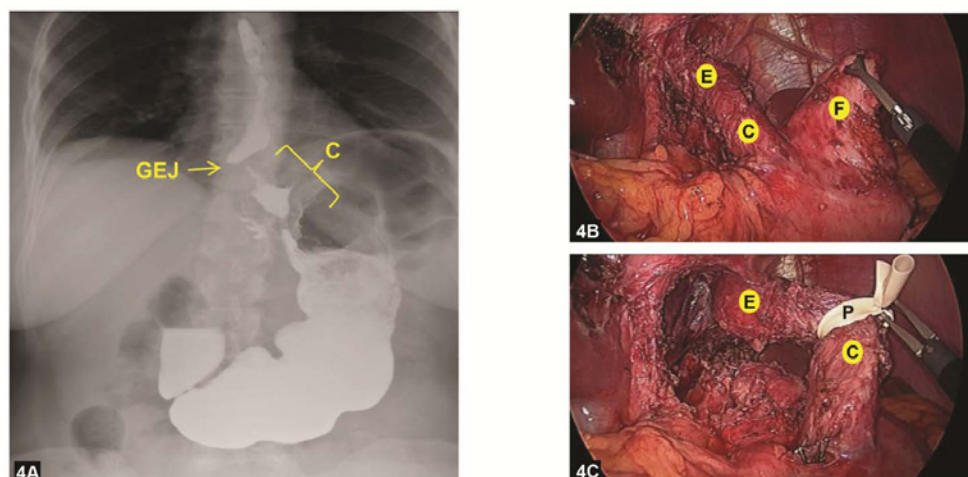


Figure 4 Collis gastroplasty.

4A: Upright view of an esophagram showing a Collis gastroplasty segment in a patient who underwent esophageal lengthening procedure for treatment of short esophagus. GEJ: Gastroesophageal junction; C: Collis gastroplasty segment.

4B/C: Laparoscopic view of a Collis gastroplasty segment in a patient who had undergone an esophageal lengthening procedure. E: Esophagus; P: Penrose drain used to retract the Collis segment; C: Collis gastroplasty segment; F: Fundic remnant after gastric wedge excision to construct a Collis gastroplasty segment.

reported in 64-84% of reoperative antireflux surgeries [4,15]

We previously reported herniated fundoplication in 45/50 (90%) of reoperative antireflux procedures performed in our center, with a paraesophageal component in 22/50 (44%) [16]. Herniation of the fundoplication is the result of transdiaphragmatic migration of the fundoplication or one of the lips of the fundoplication. Most commonly, the left lip of the fundoplication herniates into the mediastinum, along the esophagus and medial to the left crus, resulting in a recurrent paraesophageal hiatal hernia.

The herniation of the fundoplication may occur as the result of incomplete esophageal mediastinal mobilization with lack of tension-free, intra-abdominal esophageal length at the time of repair, and/or inadequate crural closure. Disruption of the crural closure may occur if the closure is under tension, or is too tight, causing strangulation of the crura, or as the result of sudden increase in abdominal pressure, such as heavy lifting or abdominal trauma.

The two most important steps for prevention of a herniated fundoplication are adequate mediastinal esophageal mobilization to achieve tension-free, intra-abdominal esophageal length [7] and adequate crural closure.

The majority of patients with radiographic recurrence have a small hiatal hernia and are asymptomatic. Careful attention should be given in patients with symptoms such as acute onset dysphagia, abdominal pain, nausea, vomiting and melena, which could be indicative of a large recurrent hiatal hernia, gastric volvulus, and strangulation or bleeding.

On esophagram, a herniated fundoplication appears similar to a primary hiatal hernia with the fundus of the stomach above the diaphragmatic crura. In contrast to primary hiatal hernia, which

mostly shows free passage of contrast and evidence of reflux at the level of gastroesophageal junction, a recurrent hiatal hernia, in most cases, is associated with a visible segment of narrow passage of contrast, indicative of a fundoplication.

On the endoscopic antegrade view, the gastroesophageal junction is seen above the crural impression, similar to a primary hiatal hernia. On the retroflexed view, the fundoplication is seen above an opening in the crural impression. The laparoscopic view of a herniated fundoplication shows scar tissue between the lesser curvature of the stomach and liver, as well as at the level of the esophageal hiatus. The recurrent paraesophageal component mostly herniates medial to the left crus, which may result in twisted fundoplication as the result of displacement of the fundoplication into the left chest. Descriptive images are shown in (Figure 5).

Slipped fundoplication

Slipped fundoplication is reported as the pattern of failure in 4-32% of reoperative antireflux surgeries [4,15,16]. A slipped fundoplication occurs as the result of a technical error, where the fundoplication is misplaced around the stomach instead of its correct anatomical location around the esophagus. The most common cause of a slipped fundoplication is inadequate esophageal mediastinal mobilization and failure to achieve a tension-free, intra-abdominal esophageal length.

On esophagram, a slipped fundoplication appears as an hourglass shape, with the fundoplication placed below the diaphragmatic crus, below the gastroesophageal junction and around the stomach. If the crural closure is defective, a slipped fundoplication may herniate into the chest, and the fundus of the stomach may be seen above the diaphragm. On the endoscopic retroflexed view, a slipped fundoplication appears below the

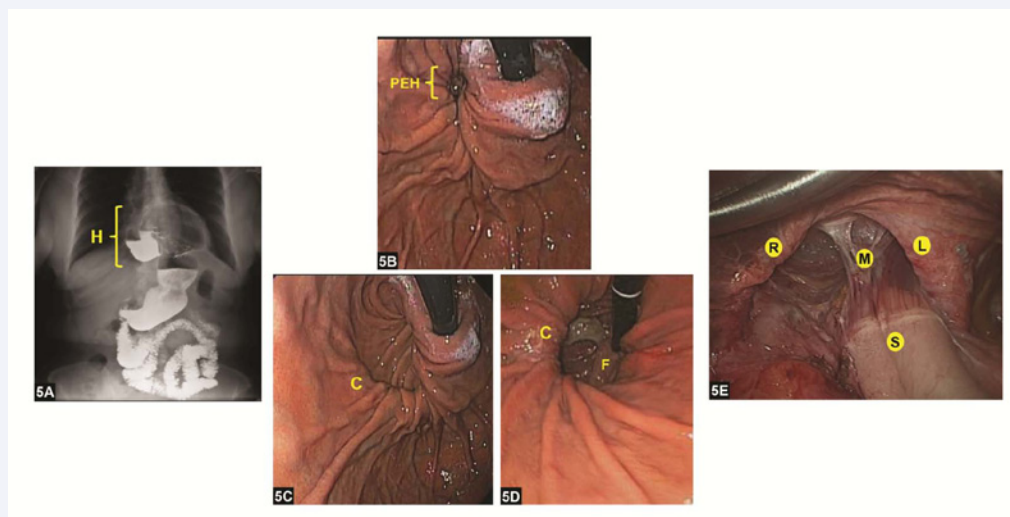


Figure 5 Herniated fundoplication.

5A: Upright view of an esophagram showing a recurrent hiatal hernia. H: Herniated Nissen fundoplication and upper portion of the stomach.

5B: Retroflexed endoscopic view of a small recurrent paraesophageal hiatal hernia along the axis of the fundoplication. PEH: Paraesophageal hernia.

5C: Retroflexed endoscopic view of a large paraesophageal hernia in a patient who has a partially twisted Nissen fundoplication. C: Crura.

5D: Retroflexed endoscopic view of a herniated fundoplication. F: Fundoplication, which has herniated into the chest, and is seen above the crural impression; C: Crura.

5E: Laparoscopic view of a herniated fundoplication. R: Right crus; L: Left crus; M: Mediastinal adhesions; S: Stomach.

crural impression (in contrast to a herniated fundoplication, in which the fundoplication appears above the diaphragm). If the crural closure is defective, the crural impression will be seen as an opening above the fundoplication. The laparoscopic view of a slipped fundoplication shows scar tissue and visible fundoplication in the abdomen below the diaphragmatic crura. Descriptive images are shown in (Figure 6).

Tight fundoplication

Tight fundoplication is reported as the pattern of failure in 4.2-9.5% of reoperative antireflux surgeries [4,15]. In our report of 50 redo antireflux surgeries, tight fundoplication was seen in 3/50 (6%) patients [16].

A tight fundoplication can be caused by 4 mechanisms: 1) The fundoplication may be too tight at the time of construction. To construct a Nissen fundoplication, a 58-60 French Bougie is usually inserted inside the esophagus and the fundoplication is created while the Bougie remains in place to prevent narrowing of the esophageal lumen. The usage of smaller Bougies may result in tight fundoplication and postoperative dysphagia. In contrast, there are reports of Nissen fundoplication without the use of Bougie and with very little postoperative dysphagia [17]. Therefore, the use of a Bougie, or the size of the Bougie, may not be the only contributing factor to a tight fundoplication; 2) Postoperative edema can cause transient dysphagia, which should resolve in up to 8-12 weeks following surgery; 3) The crural closure may be too tight, causing strangulation of the esophagus; and 4) In patients with esophageal dysmotility, any resistance caused by fundoplication may result in delay of passage of contrast through the gastroesophageal junction, mimicking a tight fundoplication. Therefore, a careful assessment of preoperative esophageal motility is a key factor in the selection of patients for a Nissen fundoplication.

The most common symptoms in patients with tight fundoplication are dysphagia to solids and liquids and regurgitation of undigested food. Transient dysphagia is a common symptom after fundoplication. However, patients should tolerate liquids before they are discharged. Inability to tolerate liquids or swallow saliva prior to discharge is an alarming sign and should prompt further investigation to rule out a tight or

twisted fundoplication.

Endoscopic esophageal dilations have been traditionally used for treatment of tight fundoplication [18]. Conversion from a Nissen to a Toupet fundoplication is an option if dilations fail. On esophagram, a tight fundoplication appears as an area of narrowing with minimal or no passage of contrast through the gastroesophageal junction. There may be dilation of the esophagus with pseudoachalasia and a bird's beak appearance at the level of gastroesophageal junction, mimicking achalasia. On the endoscopic retroflexed view, a tight fundoplication, in the immediate postoperative period, may show tissue edema. Following the resolution of tissue edema and postoperative changes, a tight fundoplication on the retroflexed view should appear no different from an intact fundoplication. On antegrade view, there may be food or saliva in the esophagus and resistance to passage of the scope through the gastroesophageal junction, indicative of mechanical obstruction. The laparoscopic view of a tight fundoplication shows scar tissue. If the crural closure is too tight, the strangulation of the esophagus may be visible. The laparoscopic appearance of a tight fundoplication may be no different from an intact fundoplication. Descriptive images are shown in (Figure 7).

Loose/Disrupted fundoplication

Loose or disrupted fundoplication is reported as the pattern of failure in 8.4-22.7% of reoperative antireflux surgeries [15,19]. Loose/disrupted fundoplication occurs as the result of a technical error at the time of the construction of the fundoplication, as the result of undivided short gastric vessels or failure to achieve tension-free, intra-abdominal length that would put the fundoplication under tension. The disruption of the fundoplication can occur at a later time, most commonly as the result of an increase of intra abdominal pressure with abdominal trauma or heavy lifting. The clinical manifestation includes recurrence of symptoms of heartburn and regurgitation.

On esophagram, a loose/disrupted fundoplication may show the 2 lips of fundoplication separated from each other or from the esophagus. The esophagram may show free passage of contrast through the gastroesophageal junction and evidence of reflux. On the endoscopic retroflexed view, a loose and disrupted

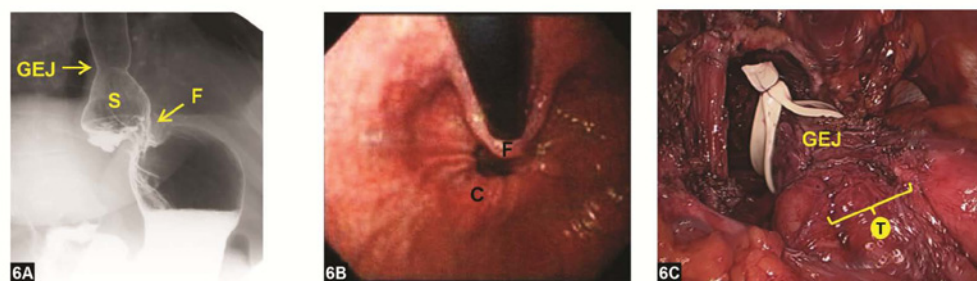


Figure 6 Slipped fundoplication.

6A: Upright view of an esophagram showing a slipped Toupet

fundoplication. GEJ: Gastroesophageal junction; S: Stomach above the fundoplication; F: Fundoplication placed around the stomach.

6B: Retroflexed endoscopic view of a slipped fundoplication. F: Fundoplication placed around the stomach below the crural impression; C: Crura.

6C: Laparoscopic view of a slipped Toupet fundoplication placed below the gastroesophageal junction (GEJ). T: Toupet fundoplication placed around stomach.



Figure 7 Tight fundoplication.

7A: Esophagram showing a tight Nissen fundoplication.

7B: Esophagram showing a tight Toupet fundoplication.

7C: Retroflexed endoscopic view showing a tight fundoplication caused by postoperative edema.

7D: Laparoscopic view of a tight fundoplication caused by a combination of both the fundoplication and the surrounding scar tissue. E: Esophagus; N: Nissen fundoplication; S: Scar tissue.

fundoplication appears partially undone with effacement of the depth of fundoplication. The laparoscopic view of a loose/disrupted fundoplication shows scar tissue. The separation of the 2 lips of the fundoplication is visible after scar tissue is divided. Descriptive images are shown in (Figure 8).

Twisted fundoplication

Twisted fundoplication is reported as the pattern of failure in 1.1-20% of reoperative antireflux surgeries [4,20]. A twisted fundoplication may occur as the result of 2 mechanisms: 1) The fundoplication may be twisted at the time of construction because of undivided short gastric vessels or misplacement of fundoplication sutures; and 2) A twisted fundoplication may be associated with herniation of the fundoplication when one lip of the fundoplication, more commonly the left lip, herniates into the chest. The herniation results in a change in the axis of the fundoplication, resulting in a twist.

The most common symptoms are inability to tolerate liquids or swallow saliva in the immediate postoperative period, without gradual resolution. It is imperative to perform an upper endoscopy to assure easy passage of the scope through the gastroesophageal junction at the completion of the fundoplication. New onset dysphagia and regurgitation of undigested foods or liquids in the postoperative period are indicative of a recurrent hiatal hernia with possible twisted fundoplication. It is important to distinguish a tight from a twisted fundoplication, since the former may respond to esophageal dilation and the latter will not. On esophagram, a twisted fundoplication may show esophageal dilation above the diaphragm. The twisted fundoplication may be associated with hiatal hernia and features of herniated fundoplication may be visible.

On the endoscopic antegrade view, there may be retained food or saliva in the esophagus. On the retroflexed view, a twisted fundoplication may appear partially undone with effacement of the depth of fundoplication. A twist is visible when the upper and lower parts of the fundoplication are located in different axes. If the fundoplication is fully rotated, a complete twist is visible in the retroflexed view. The twisted fundoplication may be associated with hiatal hernia and an opening in the crural impression may be visible. The laparoscopic view of a twisted

fundoplication shows scar tissue. The twist of the fundoplication with the 2 lips of the fundoplication in different axes is visible after scar tissue is divided. A discrepancy in size between the 2 lips may be seen. The twisted fundoplication may be associated with hiatal hernia and features of herniated fundoplication may be present. Descriptive images are shown in (Figure 9).

Delayed gastric emptying

Delayed gastric emptying is reported in 0-4% following Nissen fundoplication [21,22]. The etiology may be multifactorial and not related to the fundoplication itself. It is known that GERD can be associated with gastric pathology and delayed gastric emptying [23] and patients with large hiatal hernia and intrathoracic stomach may have delayed gastric emptying because of distorted anatomy. Fundoplication is known to increase gastric emptying of both solids and liquids [23,24] as the result of a decrease in the size of the proximal stomach, which accelerates emptying [25], and a decrease in fundic postprandial relaxation [26].

In contrast, in a few cases, delayed gastric emptying may occur following fundoplication for two possible reasons: 1) The postoperative edema of the gastric wall, which may decrease gastric peristalsis; and 2) Vagal injury or transient postoperative neuromyopathy that may affect gastric function and result in delayed gastric emptying. However, the reported data on the relationship between the vagal damage and alteration of gastric emptying are variable. In a study of 76 patients who underwent laparoscopic repair of paraesophageal hiatal hernia, postoperative vagal injury was reported in 3 (4%). All three developed symptoms of delayed gastric emptying [22]. In contrast, in a study of 41 patients who underwent partial fundoplication and had objective assessment of vagal function and gastric emptying, injury to the vagus nerves was reported in 3 (10%), but did not seem to affect the gastric emptying [21].

When evaluating patients with delayed gastric emptying after fundoplication, the focus should be on a thorough questionnaire of preoperative symptoms and possible missed preoperative gastric pathology, rather than the fundoplication as the cause.

The most common symptoms of delayed gastric emptying are early satiety, nausea and vomiting. Delayed emptying after

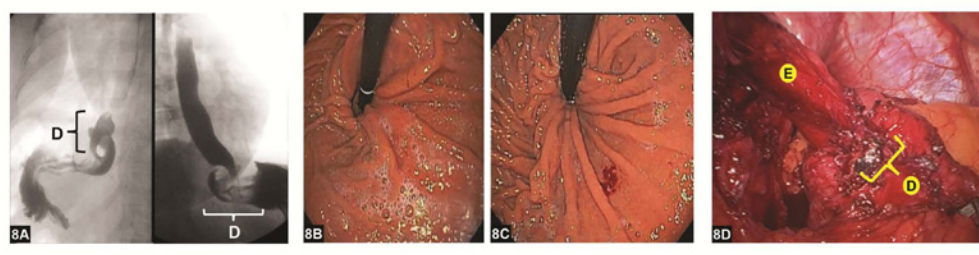


Figure 8 Loose/Disrupted fundoplication.

8A: Esophagram showing 2 views of a disrupted fundoplication in the same patient. D: Disrupted fundoplication.

8B: Retroflexed endoscopic view showing a loose fundoplication, which remains partially intact.

8C: Retroflexed endoscopic view showing a disrupted fundoplication with effacement of the depth of the fundoplication.

8D: Laparoscopic view of a disrupted Nissen fundoplication, which is partially undone. E: Esophagus; D: Disrupted Nissen fundoplication.

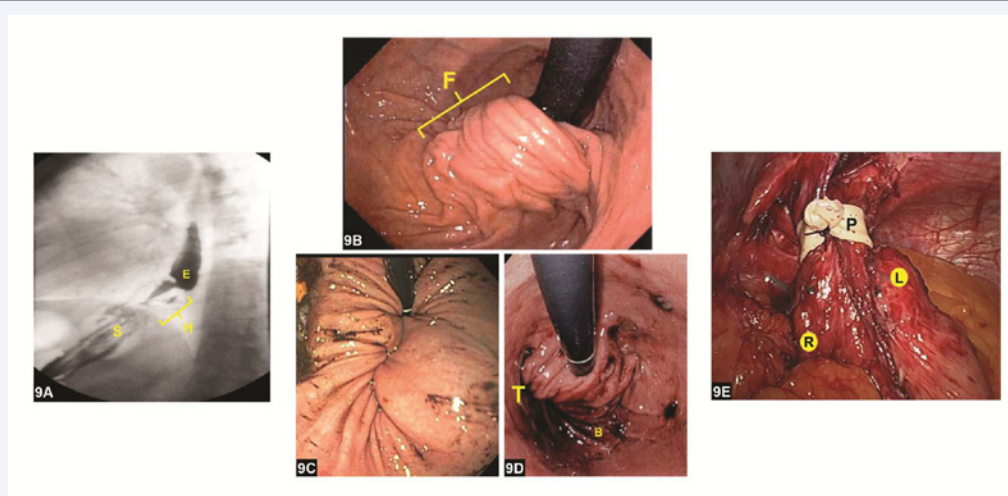


Figure 9 Twisted fundoplication.

9A: Prone oblique view of an esophagram showing a twisted fundoplication causing torsion at the level of the gastroesophageal junction. E: Esophageal dilation above the twisted gastroesophageal junction; T: Twisted and herniated fundoplication; S: Stomach.

9B: Retroflexed endoscopic view of a twisted fundoplication. The top of the fundoplication is not visible as the result of to significant twisting of the fundoplication. F: Fundoplication.

9C: Twisted fundoplication associated with herniation of the wrap.

9D: Twisted fundoplication showing the bottom (B) and the top (T) of the fundoplication in different axes.

9E: Laparoscopic view of a twisted Toupet fundoplication showing the lips of the fundoplication in different axes and with discrepancy in size. P: Penrose drain around the esophagus; R: Right lip of the fundoplication; L: Left lip of the fundoplication.

fundoplication is transient in most cases and may respond to prokinetics and antiemetic agents [27]. In few patients with severe symptoms who do not improve with time, a gastrostomy tube, a jejunostomy tube, pyloroplasty, gastric electrical stimulation, partial gastrectomy with Roux-en-Y gastrojejunostomy, or Roux-en-Y esophagojejunostomy are potential options. Descriptive images are shown in (Figure 10).

Mesh-related complications

The complications associated with the use of mesh are reported in case series and include mesh erosion [28], esophageal stenosis and dense fibrosis. There is no relationship between the type of mesh and its configuration, and mesh-related complications [29]. Mesh erosion can happen up to years following surgery. The clinical manifestations are fever, chills, chest pain, epigastric pain and shortness of breath as the result of pleural effusion. The

treatment requires removal of the mesh, drainage, esophageal stenting, diversion or esophagectomy depending on the degree of esophageal damage and the condition of the patient.

An esophageal perforation caused by VICRYL® (Ethicon, Somerville, New Jersey) and EVICEL® (Ethicon, Somerville, New Jersey) mesh erosion, on CT scan, antegrade endoscopic view and laparoscopic view is shown in (Figure 11).

Gastroesophageal fistula

Gastroesophageal fistula is a very rare complication of antireflux surgery presented in isolated cases [30]. The fistula can occur within weeks to years postoperatively. The etiology is erosion of sutures and esophageal damage associated with reoperative procedures. The symptoms include dysphagia and epigastric pain. Symptomatic patients have been treated with Roux-en-Y esophagojejunostomy with the anastomosis above the

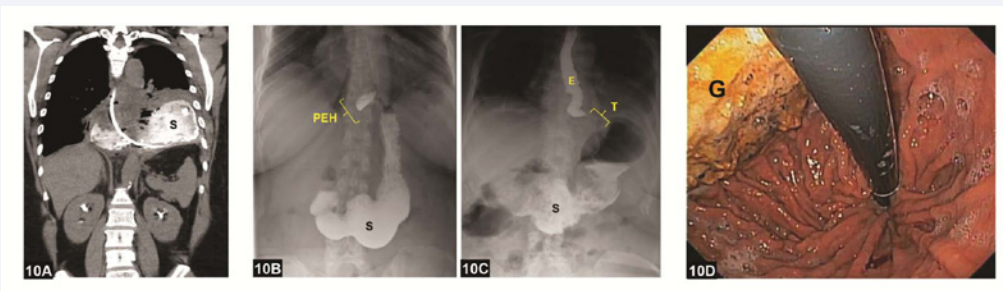


Figure 10 Delayed gastric emptying.

10A: Coronal view of a CT scan showing retained contrast in the stomach in a patient with a large recurrent paraesophageal hiatal hernia with a nasogastric tube (in white color) in the stomach. S: Stomach with retained contrast.

10B: Upright view of an esophagram showing retained contrast in a patient with a small recurrent paraesophageal hernia and delayed gastric emptying. PEH: Paraesophageal hernia.

10C: Upright view of an esophagram showing retained contrast in a patient with an intact fundoplication and delayed gastric emptying. E: Esophageal dilation proximal to the fundoplication; T: Toubert fundoplication.

10D: Retroflexed endoscopic view showing retained gastric contents (G) after a night of fasting in a patient with a Nissen fundoplication. The fundoplication is partially undone manifested by effacement of the depth of the fundoplication.

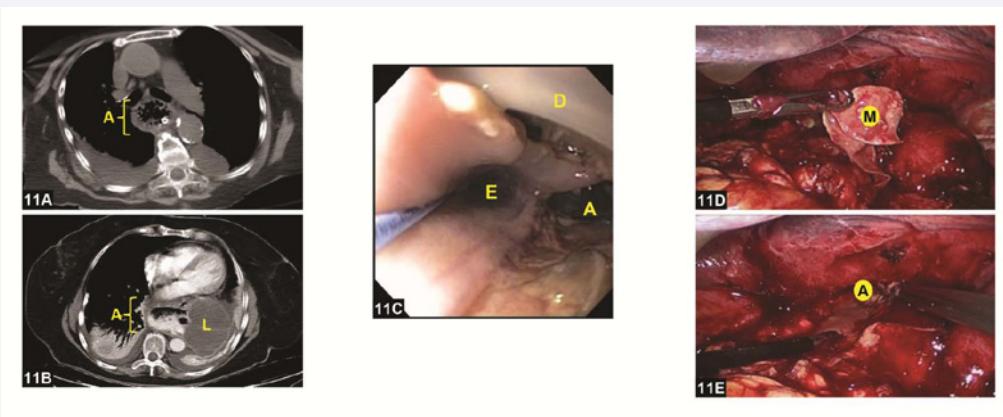


Figure 11 Mesh erosion into the esophagus.

11A/B: CT imaging showing an abscess cavity within the mediastinum as the result of erosion of VICRYL mesh and EVICEL into the esophagus. A: Abscess cavity in the mediastinum; L: Loculated pleural effusion.

11C: Antegrade endoscopic view of the mediastinal abscess with a drain in place. E: true esophageal lumen with a guidewire in place; A: Abscess cavity in the mediastinum; D: Drain in the mediastinum.

11D/E: Laparoscopic view of the drainage procedure. M: Mesh, which had eroded into the esophagus. A: Abscess cavity in the mediastinum drained transabdominally.

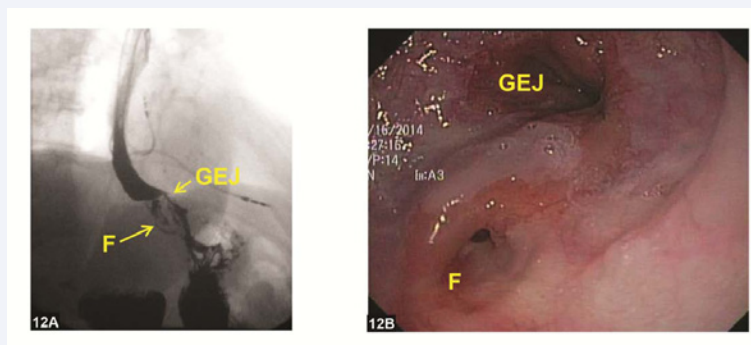


Figure 12 Gastroesophageal fistula.

12A: Upright view of an esophagram showing an esophagogastric fistula caused by a gastroesophageal junction leak after transabdominal reoperative Nissen fundoplication. GEJ: showing passage of contrast through the gastroesophageal junction; F: Fistulous tract.

12B: Endoscopic view of the esophagogastric fistula. GEJ: Gastroesophageal junction; F: Fistulous lumen.

fistulous tract [31].

We have treated one patient with a gastroesophageal fistula. The patient had undergone a transabdominal reoperative Nissen fundoplication for recurrent hiatal hernia and presented with new onset dysphagia 4 years following surgery. An upper endoscopy showed a fistulous tract of 9 mm between the esophagus and the fundus at the level of gastroesophageal junction. The mucosal lining of the tract was gastric mucosa. An esophageal stent was placed in the true gastroesophageal lumen for 6 weeks. Repeat endoscopy showed the fistulous tract was closed and she remained asymptomatic. Descriptive images of a gastroesophageal fistula shown in (Figure 12).

CONCLUSION

When treating patients with failed fundoplication and complications of antireflux surgery, it is essential to recognize the complexity of each case, the clinical manifestation, the radiographic presentation and the endoscopic features. Patients who present with recurrent symptoms or new onset symptoms following antireflux surgery need a thorough history and physical exam, as well as radiographic and endoscopic assessment. Primary care physicians, gastrointestinal radiologists and expert gastroenterologists play an essential role in prompt diagnosis and treatment. The presentation of the radiographic, endoscopic and laparoscopic images depicted in this article provides a useful diagnostic reference that may facilitate the diagnosis and treatment and, improve outcomes of patients with failed fundoplication and complications of antireflux surgery.

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