There are many types of diaphragmatic hernias and the terminology used to classify them is often confusing. The common feature of all is that some portion of the stomach has been displaced into the thorax. Anatomically, there are hernias through the diaphragmatic esophageal hiatus and those distinct from the hiatus. The latter are more correctly called “parahiatal diaphragmatic” hernias, the classic examples being congenital hernias through the diaphragmatic muscle proper, such as a Bochdalek or Morgagni hernia. This article addresses hernias through the esophageal hiatus. When describing hiatal hernias, the authors favor the traditional classification, which defines the hiatal hernia according to the position of the gastroesophageal junction (GEJ) and the extent of herniated stomach.

Type I hiatal hernia is a sliding hernia that occurs with migration of the GEJ into the posterior mediastinum through the hiatus because of laxity of the phrenoesophageal ligament (Fig. 1). This type accounts for more than 95% of hiatal hernias. Most small type I sliding hernias are asymptomatic. When they enlarge, the predominant symptom is gastroesophageal reflux.

Type II is a true paraesophageal hernia (PEH), which occurs when the fundus herniates through the hiatus alongside a normally positioned GEJ by a defect in the phrenoesophageal membrane (Fig. 2). This is the least common type of hiatal hernia.

Type III is a combination of types I and II hernias with cranially displaced GEJ and stomach through the hiatus (Fig. 3). As the hiatal hernia enlarges and more stomach herniates, volvulus of the intrathoracic stomach may develop because of tethering of the lesser curve of the stomach by the gastrohepatic omentum and left gastric vessels.

Type IV is a hernia characterized by displacement of the stomach with other organs, such as the colon, spleen, and small bowel into the chest.

Although this classification is commonly used in the literature and accurately describes the anatomic spectrum of hiatal hernias, from a practical perspective these patients are divided into those with sliding hiatal hernias (type I) and those with PEHs (any one of types II, III, or IV). The literature on PEHs rarely specifies the type of hiatal hernia with authors typically grouping types II, III, and IV together. Distinguishing between these types of hernias is important, however, because type II usually does not require a gastroplasty, whereas types III or IV hernias may require an esophageal lengthening procedure. For the purposes of this article the focus is primarily on the management of type II to IV hernias, referred to collectively as “paraesophageal” hernias.
CLINICAL PRESENTATION

Although the exact figure is unknown, it is estimated that approximately 50% of patients with PEH are asymptomatic. Confounding the issue is the presence of symptoms that are often nonspecific, minor in severity, and incorrectly ascribed to the “aging process” in this generally elderly patient population. A thorough history often uncovers symptoms related to PEH that were not previously reported on less detailed questioning. When present, symptoms and complications of PEH are reflective of the mechanical alterations caused by the hernia. Broadly, symptoms are either caused by obstruction or by gastroesophageal reflux resulting from a dysfunctional lower esophageal sphincter (LES).

Mechanical obstruction of either the distal esophagus or stomach can result in dysphagia, epigastric pain, vomiting, postprandial fullness, early satiety, or dyspnea. Dysphagia and postprandial discomfort are the most commonly reported symptoms, occurring in more than 50% of symptomatic patients. These symptoms may be minor and episodic, or become severe and unremitting. Occasionally, patients may present with severe epigastric pain caused by incarceration and gastric obstruction. If obstruction persists the stomach distends and ischemia, perforation, and septic shock may ensue. In 1904, Borchardt described a triad of symptoms seen in patients with acute obstruction from PEH that included chest pain, retching with inability to vomit, and inability to pass a nasogastric tube. This rare acute presentation represents a surgical emergency.

Dysfunctional LES resulting from displacement of the stomach into the chest may cause symptoms related to gastroesophageal reflux disease (GERD). Although not as common as symptoms caused by mechanical obstruction, GERD symptoms, such as heartburn, chronic cough, regurgitation, and aspiration, may be reported on careful history.

Important signs associated with PEH are recurrent pneumonia from aspiration and iron deficiency anemia from chronic blood loss. This bleeding may be secondary to esophagitis caused by GERD but more frequently is caused by erosions or ulcerations of the mucosa at an area of gastric folding, called Cameron lesions or ulcers. This anemia resolves in greater than 90% of patients following repair of the hernia.

Fig. 1. Type I sliding hernia. (From Ilves R. Hiatus hernia: the condition. Chest Surg Clin N Am 1998;8:404; with permission.)

Fig. 2. Type II paraesophageal hernia. The GEJ remains below the diaphragm. (From Ilves R. Hiatus hernia: the condition. Chest Surg Clin N Am 1998;8:404; with permission.)

Fig. 3. Type III paraesophageal hernia. Larger hernia with GEJ above the diaphragm. (From Ilves R. Hiatus hernia: the condition. Chest Surg Clin N Am 1998;8:404; with permission.)
EVALUATION

Evaluation of a patient with a known or suspected PEH depends on the acuity of the presentation and surgeon preference. The goals of the diagnostic evaluation are to establish or confirm the diagnosis of PEH, define the anatomy of the hernia, rule out associated pathologies, and determine the presence or absence of GERD.

Plain chest radiograph often identifies a PEH by revealing a retrocardiac air-fluid level within the intrathoracic stomach. In the acutely unwell patient radiographs may reveal evidence of gastric compromise and perforation manifested as pneumomediastinum or pneumoperitoneum. CT of the chest and abdomen may also provide additional information on the type and location of the hernia. The most important test in establishing a diagnosis of PEH is the upper gastrointestinal (UGI) series. Key information obtained from this contrast study is the anatomic location of the esophagus and stomach and, more specifically, the position of the GEJ. In some cases, the UGI series reveals complete obstruction caused by gastric volvulus. This radiographic finding indicates a patient requiring urgent surgical intervention.16

Endoscopy should be performed on all patients being evaluated for PEH. Esophagoscopy rules out associated pathologies and establishes the diagnosis of PEH while defining the location of the GEJ and the size and type of hernia. In type I hernias, the GEJ and gastric pouch extend above the impression made by the diaphragmatic crura, whereas in a type II hernia there is a separate orifice containing protruded stomach adjacent to a normally located GEJ. A type III hernia may be suspected on endoscopy when a large gastric pouch is seen above the diaphragm with the GEJ entering midway along the side of the pouch. Accurately defining the anatomy of a large hernia may be difficult, however, because of the inability to pass the scope through the stomach and into the antrum.

The use of manometry in the evaluation of PEH is controversial. Proponents of manometry believe that this test allows the LES to be precisely localized resulting in a more accurate classification of the type of hernia.5,17 Manometry may also be helpful in assessing the patient for esophageal shortening by measuring the inter sphincteric distance between the upper esophageal sphincters and LES.7 Further, manometry can evaluate the peristaltic function of the esophageal body, which may rule out an undiagnosed motility disorder and the function of the LES, which may assist the surgeon in tailoring an antireflux procedure to a specific patient.12,18,19 Others argue that manometry adds little to the preoperative work-up with other investigations, such as endoscopy and UGI series, able to confirm the diagnosis and classify the type of hernia. Manometry may be technically difficult to perform, with some authors noting an inability to complete the testing in more than 50% of patients with PEH.18,19 Finally, preoperative manometric findings do not influence most surgeons’ decision to perform an esophageal lengthening procedure or fundoplication when repairing a PEH.

Similarly, ambulatory pH testing in patients with PEH is not usually required12,18 because most patients have reflux on pH testing.20,21 Most surgeons also routinely perform a fundoplication as part of the PEH repair; pH testing does not alter the planned operation.22

MANAGEMENT

In the acute setting, most surgeons agree that urgent surgical intervention is indicated. In the chronic setting there is debate about indications for surgery and the best operative approach. Controversy also exists regarding the need for an esophageal lengthening procedure, fundoplication, fixation of the stomach with gastropsy or gastrostomy, and the need for prosthetic reinforcement of the hiatal closure.

Indications for Surgery

Traditionally, elective surgical repair has been recommended for all patients with PEH considered to be medically operable.17,23,24 Part of the rationale for this recommendation is based on the tendency of PEH to enlarge with time making surgery more difficult and the increasing age of the patient, which may increase the risk of complications. Some surgeons also think that patients with PEH have a high rate of developing lethal complications.25 In the classic report by Skinner and Belsey26 29% (6 of 21) of patients with documented PEH who were observed with minimal symptoms died from complications of strangulation, perforation, or bleeding. In a recent retrospective study by Allen and coworkers26 23 of 147 patients were followed after refusing surgery and none of them developed a life-threatening complication of their PEH. Only 4 of these 23 patients ultimately developed progressive symptoms requiring operation. This suggests that a selective approach to surgery is appropriate, with surgery reserved for patients who are symptomatic.18,27,28 Some surgeons believe that emergency repair of PEH is associated with a high mortality rate. In 1973, Hill29 reported a series of patients with acute gastric volvulus associated with PEH that had an
operative mortality rate of 56%. This high mortality rate provided further impetus to repair all PEH regardless of symptoms. Several recent reports, however, including a pooled analysis by Styliopoulos and coworkers, demonstrate a much lower mortality rate (5%–17%) for emergency surgery. In light of this information, it seems reasonable that asymptomatic or minimally symptomatic patients do not necessarily require surgery and that a more selective approach should be used. There remains little debate, however, that all symptomatic patients who are a good surgical risk should be repaired.

### Approach to Surgery

The three approaches for repair of PEH are (1) transthoracic, (2) transabdominal, and (3) laparoscopic. Regardless of the approach, the tenets for a successful repair of PEH are tension-free reduction of hernia contents into the subdiaphragmatic position, removal of the hernia sac, and closure of the hiatal defect. Most surgeons also agree that performing an antireflux procedure is an important element of a successful PEH repair. The role of fixation of the stomach below the diaphragm with gastroplexy or gastrostomy is an important element of a successful PEH repair. The three approaches for repair of PEH are (1) transthoracic, (2) transabdominal, and (3) laparoscopic. Advocates of the thoracic approach emphasize the ease of dissection of the hernia sac and its contents and the enhanced ability to fully mobilize the esophagus to reduce tension and minimize the need for a lengthening procedure. If a lengthening procedure is required, it is generally easier with the thoracic approach. The thoracic repair has the disadvantages of being associated with increased pain and pulmonary complications postoperatively, the need for tube thoracostomy, increased hospital stay and cost, and the potential for volvulus after reduction of the stomach into the abdomen.

Traditionally, PEH repair was through a thoracotomy or laparotomy. Proponents of the thoracic approach emphasized the ease of dissection of the hernia sac and its contents and the enhanced ability to fully mobilize the esophagus to reduce tension and minimize the need for a lengthening procedure. If a lengthening procedure is required, it is generally easier with the thoracic approach. The thoracic repair has the disadvantages of being associated with increased pain and pulmonary complications postoperatively, the need for tube thoracostomy, increased hospital stay and cost, and the potential for volvulus after reduction of the stomach into the abdomen.

Advocates of the abdominal approach argue that it permits complete mobilization of the stomach with improved reduction of the volvulus and recreation of the normal anatomy. This approach also allows other abdominal procedures, such as gastroplexy or gastrostomy, to be performed. Mobilization of the distal esophagus can be challenging, however, making gastroplasty for esophageal shortening more difficult to perform.

There are no randomized studies comparing open abdominal with thoracic approaches in the repair of PEH. Table 1 lists the outcomes of several studies of PEH repair using either technique. Comparing these series is difficult because of variable clinical and radiographic follow-up and different and inconsistent outcome measures. Low and Unger report the highest rate of recurrence (18%) with most recurrences being asymptomatic. This result likely represents a true estimate of anatomic recurrence based on the thorough follow-up investigations performed by the authors. Despite these differences, these studies indicate that both transthoracic and transabdominal approaches have good outcomes with low postoperative mortality rates and acceptable rates of recurrence.

The first report of laparoscopic repair of PEH was published in 1992. Today there is far more published literature on minimally invasive repair of PEH than on all the open series combined. Advocates of the laparoscopic approach claim that it has decreased postoperative morbidity and affords superior visualization of the hiatus and mediastinum, which allows better distal esophageal mobilization. Arguments against this approach include the advanced laparoscopic skills required to perform the surgery, the lack of long-term follow-up, and a higher recurrence rate of PEH. There are no randomized control trials comparing laparoscopic with open PEH repair to support these claims.

At the authors’ institution the short-term outcomes of primary laparoscopic and open PEH repairs were evaluated in 93 patients. The primary outcome measures included intraoperative variables, such as operative time, and postoperative variables, such as hospital stay and complications. Secondary outcomes included mortality rates, recurrence rates, and patient satisfaction. It was concluded that the laparoscopic approach was associated with a significantly longer operative time (3.1 hours) compared with the open procedure (2.5 hours). The overall hospital stay was shorter in the laparoscopic group (5 days), however, compared with the open repair group (10 days) and was associated with fewer postoperative complications. Although the follow-up was short (average 17 months), the patient satisfaction scores and recurrence rates (9%) were similar in both groups.

Table 2 lists the outcomes of several studies using the laparoscopic approach for repair of PEH. Advocates of the minimally invasive approach cite series that demonstrate decreased length of stay, lower postoperative complication rates, and lower mortality rates than the open repair. In a review of 32 different case series, Draaisma and coworkers reported a lower perioperative complication rate and a shorter mean length of stay for the laparoscopic versus the open group (3 versus 10 days). Rathore and...
Table 1
Outcomes of selected series of open thoracic and abdominal repair of PEH

<table>
<thead>
<tr>
<th>References</th>
<th>Year</th>
<th>N</th>
<th>% Lengthening Gastroplasty</th>
<th>% Good or Excellent Results</th>
<th>% Anatomic Recurrence</th>
<th>Follow-up (Months)</th>
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<td></td>
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<tr>
<td>Allen et al(^{26})</td>
<td>1993</td>
<td>124</td>
<td>68</td>
<td>93</td>
<td></td>
<td>42 (median)</td>
</tr>
<tr>
<td>Maziak et al(^{27})</td>
<td>1998</td>
<td>94</td>
<td>80</td>
<td>94</td>
<td></td>
<td>2 (median)</td>
</tr>
<tr>
<td>Altorki et al(^{24})</td>
<td>1998</td>
<td>47</td>
<td>0</td>
<td>91</td>
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<td>6 (median)</td>
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<tr>
<td>Patel et al(^{45})</td>
<td>2004</td>
<td>240</td>
<td>96</td>
<td>85</td>
<td></td>
<td>8 (median)</td>
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<td>Transabdominal repair</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Williamson et al(^{46})</td>
<td>1993</td>
<td>119</td>
<td>1</td>
<td>84</td>
<td>11</td>
<td>61 (median)</td>
</tr>
<tr>
<td>Myers et al(^{47})</td>
<td>1995</td>
<td>37</td>
<td>0</td>
<td>92</td>
<td>0.3</td>
<td>67 (median)</td>
</tr>
<tr>
<td>Low and Unger(^{48})</td>
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<td>72</td>
<td>0</td>
<td>NR</td>
<td>18</td>
<td>30 (mean)</td>
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<td>Martin et al(^{49})</td>
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<td>51</td>
<td>NR</td>
<td>86</td>
<td>4</td>
<td>27 (mean)</td>
</tr>
<tr>
<td>Geha et al(^{33})</td>
<td>2000</td>
<td>100</td>
<td>2</td>
<td>98</td>
<td>0</td>
<td>NR</td>
</tr>
</tbody>
</table>

Abbreviation: NR, not reported.

coworkers\textsuperscript{50} published a meta-analysis of non-randomized series on laparoscopic PEH repair. Inclusion was restricted to those series with greater than 25 patients and follow-up beyond 6 months. In 965 patients the overall recurrence rate was 10.2%. Among those patients formally evaluated with a contrast esophagogram postoperatively 25.5% had recurrence. Lower recurrence rates were seen in those who underwent an esophageal lengthening procedure with a Collis-Nissen gastroplasty versus those who did not (0% vs 12%). Despite both the widespread adoption of laparoscopic techniques for various procedures and the impressive published results, laparoscopic repair of PEH has not been universally adopted. In a recent international online survey of members of the Cardiothoracic Surgery Network only 48% stated they repair PEH laparoscopically, whereas 35% perform thoracotomy and 17% perform laparotomy.\textsuperscript{61}

The debate surrounding the best surgical approach for repairing PEH continues with several studies reporting that each approach can be performed safely with acceptable outcomes.

**Esophageal Shortening**

The true incidence of esophageal shortening in PEH is unknown and remains a major point of controversy. Despite having been described for over 50 years\textsuperscript{85}, questions remain as to the existence and the management of a shortened esophagus. Those who believe that shortening does not exist argue that in most patients the esophagus appears shortened because the stomach is pushing it up into the chest. Correction of the anatomic arrangement avoids the need for a lengthening procedure.\textsuperscript{53} A more commonly held view is that although short esophagus is uncommon, it remains an important cause of recurrence following PEH repair.\textsuperscript{18,64} Inadequate esophageal length limits the ability to reduce the GEJ into its normal abdominal position without tension, which predisposes to wrap herniation and anatomic recurrence.\textsuperscript{64}

The most important risk factor for esophageal shortening is the presence of periesophageal inflammation resulting from long-standing GERD.\textsuperscript{64} It is thought that GERD leads to chronic irritation followed by healing and subsequent fibrosis.\textsuperscript{65} Studies of patients diagnosed with GERD demonstrate a wide range of incidence of short esophagus (0%–60%).\textsuperscript{66–68} Other risk factors that may predispose a patient to develop esophageal shortening include Barrett esophagus, scleroderma, and Crohn disease.\textsuperscript{65,68}

Identifying patients preoperatively with shortened esophagus is problematic.\textsuperscript{69,70} There is no test that can be performed that accurately identifies the presence and degree of esophageal shortening. Several techniques have been described using endoscopic or radiologic measurements of length and manometric measurements.\textsuperscript{70–73} Unfortunately, none of these are completely reliable at predicting a shortened esophagus intraoperatively.\textsuperscript{70,74,75} The most reliable method of determining esophageal shortening is intraoperative assessment (eg, GEJ >2.5 cm below the hiatus).\textsuperscript{64,75}

When a diagnosis of short esophagus is made a lengthening procedure is necessary. This may be accomplished by further intrathoracic dissection and mobilization of the esophagus or by gastroplasty. In 1957, Collis\textsuperscript{76} described this

<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>N</th>
<th>% Lengthening Gastroplasty</th>
<th>% Anatomic Recurrence</th>
<th>Follow-up (Months)</th>
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<tr>
<td>Trus et al\textsuperscript{52}</td>
<td>1997</td>
<td>76</td>
<td>8</td>
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<td>60</td>
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<tr>
<td>Mattar et al\textsuperscript{54}</td>
<td>2002</td>
<td>136</td>
<td>5</td>
<td>43</td>
<td>18 (median)</td>
</tr>
<tr>
<td>Pierre et al\textsuperscript{55}</td>
<td>2002</td>
<td>203</td>
<td>56</td>
<td>2</td>
<td>37 (mean)</td>
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<td>2002</td>
<td>52</td>
<td>0</td>
<td>32</td>
<td>37 (mean)</td>
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<td>Diaz et al\textsuperscript{57}</td>
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<td>116</td>
<td>5</td>
<td>32</td>
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<tr>
<td>Andujar et al\textsuperscript{58}</td>
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<td>166</td>
<td>0</td>
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<td>Boushey et al\textsuperscript{59}</td>
<td>2008</td>
<td>58</td>
<td>0</td>
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procedure without fundoplication. Subsequently, fundoplication was added to prevent reflux and is referred to as Collis-Nissen. Although a Collis-Nissen is most easily done by thoracotomy, it can be performed through any approach. There is general agreement that a lengthening gastroplasty reduces the rate of recurrent herniation following repair of PEH when esophageal shortening is observed.

Esophageal shortening is less commonly identified in patients undergoing laparoscopic repair of PEH. This observation may be related to difficulty in accurately identifying the GEJ because of inadequate removal of the fat pad, elevation of the diaphragm from insufflation of carbon dioxide, or improved distal esophageal mobilization. Some surgeons may also be reluctant to perform a gastroplasty using laparoscopic techniques because of technical challenges. Long-term follow-up of patients undergoing laparoscopic repair of PEH is necessary to determine if decreased use of gastroplasty in the laparoscopic approach results in higher recurrence rates.

**Antireflux Procedure**

Although limited data confirm the need for fundoplication, most surgeons perform an antireflux procedure when repairing a PEH because the fundoplication helps to anchor the stomach in the abdomen and because of the need to recreate a barrier to reflux. The extensive dissection necessary for full mobilization of the hernia sac and esophagus completely disrupts the hiatal mechanism and may render the GEJ incompetent resulting in postoperative reflux. An incidence of postoperative reflux as high as 65% in patients who did not receive a fundoplication has been reported. These results have been disputed and a few argue that significant postoperative reflux is much less common in patients without fundoplication and, if present, can be managed with medical therapy. Some authors believe that avoiding a fundoplication decreases the risk of postoperative dysphagia and operative complications, and shortens the operative time for patients who are often elderly with significant medical comorbidities. These authors suggest that fundoplication should be performed selectively in patients diagnosed with GERD on preoperative evaluation.

**Fixation of the Stomach with Gastropexy or Gastrostomy**

In many patients, reherniation occurs because of positive intra-abdominal pressure and negative intrathoracic pressure creating a cephalad force that favors migration of the stomach into the thorax. By anchoring the stomach below the diaphragm by gastropexy or gastrostomy, it is hoped that this migration is avoided. Surgeons who argue for gastrostomy note that it is fast and simple to perform; however, a high rate of recurrence has been reported using this technique. Those who favor gastrostomy argue that it provides a solid anchoring point to prevent recurrence and decreases the risk of intra-abdominal gastric volvulus. Gastrostomy also effectively decompresses the stomach and eliminates the need for a nasogastric tube postoperatively. Those surgeons who oppose fixation of the stomach report that reherniation is not prevented because the stomach is pliable and merely stretches in response to the cephalad force. No prospective randomized study has been reported that proves that either of these two techniques reduces the rate of recurrence.

**Mesh Reinforcement of the Crural Repair**

PEH repair is often complicated by excessive tension of the hiatal closure, attenuated crura with poor quality tissue, and unrecognized esophageal shortening. These factors predispose the crural repair to disruption and lead to reherniation. To improve the strength of the crural repair, surgeons have used prosthetic mesh. This approach is supported by the successful use of mesh for the repair of inguinal and incisional hernias. In these patients, the mesh causes secondary in-growth and fibrosis and significantly reduces the incidence of hernia recurrence.

Data supporting the use of prosthetics for crural reinforcement during PEH repair are limited because most studies are small observational case series using different techniques of repair and different prosthetic materials. Three techniques for mesh placement have been described with each intended to provide mechanical support to the hiatal closure: (1) primary closure of the crura followed by prosthetic onlay, (2) the “keyhole” technique whereby a slit and hole are cut into the mesh and it is placed around the esophagus onto the crura, and (3) the “tension free” repair whereby the hiatal defect is left open and mesh is used to bridge the gap between the crura.

Prosthetic insertion may cause complications including erosion into the esophagus, adhesions, fibrotic strictures, and dysphagia. Prosthetic erosion is rare but catastrophic and may require esophagectomy as definitive management. To address these concerns, biologic mesh, such as porcine small intestinal submucosa and...
<table>
<thead>
<tr>
<th>References</th>
<th>Year</th>
<th>N</th>
<th>% Recurrence</th>
<th>Prosthetic Material</th>
<th>Placement of Mesh</th>
<th>Follow-up (Months)</th>
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<td></td>
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<td>Hui et al&lt;sup&gt;97&lt;/sup&gt;</td>
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<td>37</td>
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<tr>
<td></td>
<td>12 M</td>
<td>8</td>
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<td>23 NM</td>
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<tr>
<td></td>
<td>10 M</td>
<td>10</td>
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<td>36 NM</td>
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<td></td>
<td>51 SM</td>
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</table>

Abbreviations: M, mesh; NM, no mesh; PP, polypropylene; PTFE, polytetrafluoroethylene; SIS, small intestinal submucosa; SM, synthetic mesh.

acellular human dermis, have been investigated.\textsuperscript{22,40} Theoretically, these materials are safer because they act as infection-resistant temporary scaffolding that allows for native tissue in-growth without the degree of scarring created by synthetic mesh.\textsuperscript{95,96}

Despite the drawbacks listed previously, there is increasing evidence\textsuperscript{90,97–99} including two prospective randomized controlled trials\textsuperscript{88,89} suggesting that mesh reinforcement of crural closure decreases the risk of reherniation (Table 3). Oelschlager and coworkers\textsuperscript{100} demonstrated similar results using bioprosthetic mesh with no mesh-related complications reported. Long-term follow-up is required to ensure that erosion into the esophagus does not occur with newer materials.

**SUMMARY**

Practically, hiatal hernias are divided into sliding hiatal hernias (type I) and PEH (types II, III, or IV). Patients with PEH are usually symptomatic with GERD or obstructive symptoms, such as dysphagia. Rarely, patients present with acute symptoms of hernia incarceration, such as severe epigastric pain and retching. A thorough evaluation includes a complete history and physical examination, chest radiograph, UGI series, esophagogastroscopy, and manometry. These investigations define the patient's anatomy, rule out other disease processes, and confirm the diagnosis. Operable symptomatic patients with PEH should be repaired. The underlying surgical principles for successful repair include reduction of hernia contents, removal of the hernia sac, closure of the hiatal defect, and an antireflux procedure. Debate remains whether a transthoracic, transabdominal, or laparoscopic approach is best with good surgical outcomes being reported with all three techniques. Placement of mesh to buttress the hiatal closure is reported to reduce hernia recurrence. Long-term follow-up is required to determine whether the laparoscopic approach with mesh hiatoplasty becomes the procedure of choice.

**REFERENCES**


