15 Surgical Management of Complicated Paraesophageal Hernias

Angela M. Kao and Paul D. Colavita

Introduction

The acute surgical management of complicated paraesophageal hernias (PEH) remains technically challenging for many surgeons. Nonelective repairs are associated with increased perioperative risk, particularly in elderly, frail patients due to the presence of other medical comorbidities [1–3]. Acute presentation with complications of strangulation, perforation, and severe ulceration causing gastrointestinal (GI) hemorrhage has been shown to significantly increase patient morbidity, with a recently reported mortality rate of 5.5% after all emergent paraesophageal hernia repairs (PEHR) [4]. Few studies have specifically evaluated the options for surgical management of complicated PEH, including the utility of minimally invasive approaches in the emergent setting. Furthermore, damage control options in the contaminated setting of necrosis or perforation remain poorly described, yet may be life-saving temporizing measures in medically frail patients or cases where surgeons lack adequate expertise to perform a definitive repair.

Indications for Repair

Although the pendulum has recently shifted toward conservative management for asymptomatic and mildly symptomatic patients [5], surgical consultation is warranted for symptomatic patients, often with consideration for surgical repair in the semi-elective or elective setting. Acute presentation with intractable or obstructive symptoms should raise concern for potential complications associated with PEH that warrant inpatient admission and surgical evaluation for urgent operative treatment. Progression from incarceration or volvulus to acute strangulation is characterized by vascular compromise of the stomach or other organs that can result in mucosal ischemia, gangrene, and impending perforation. Emergent complications associated with PEH, such as perforation and necrosis, can be life-threatening and require immediate intervention [6, 7].

In addition to symptomatic patients, PEHR is often recommended for surgically fit patients with type IV PEH or massive PEH, as these are rarely asymptomatic and symptoms of dysphagia and early satiety tend to increase over time [8]. Furthermore, patients with large PEH often have accompanying respiratory complaints due

A. M. Kao (✉)
Department of Surgery, Carolinas Medical Center, Charlotte, NC, USA
e-mail: angela.kao@atriumhealth.org

P. D. Colavita
GI and Minimally Invasive Surgery, Department of Surgery, Carolinas Medical Center, Charlotte, NC, USA

R. Lim (ed.), *Multidisciplinary Approaches to Common Surgical Problems*,
https://doi.org/10.1007/978-3-030-12823-4_15

to the reduction in thoracic volume. Although the degree of PEH-related dyspnea is often underappreciated and attributed to other patient comorbidities, the benefits of PEHR for respiratory symptoms have been studied [9]. Carrott et al. evaluated 120 patients with large PEH and demonstrated improved pulmonary function tests (PFT) after PEHR with a correlation between degree of PFT improvement and amount of intrathoracic stomach [10]. Additionally, among patients with large PEH and preoperative dyspnea, 75% reported complete relief of respiratory symptoms after PEHR [10].

Although Cameron ulcers are more likely to manifest as occult gastrointestinal bleeding (GIB) and chronic anemia, acutely bleeding ulcers can occasionally cause massive hemorrhage and are unlikely to be controlled with endoscopic therapies alone [11]. In one case series of 25 patients with severe upper gastrointestinal hemorrhage secondary to Cameron ulcers, surgery was performed in 10 patients who failed initial medical therapy, including 3 patients who required rehospitalization for rebleeding [12]. Clinically significant GIB originating from Cameron ulcers occurs with greater frequency when patients have multiple ulcerations in a large hiatal hernia; however, their location at the hernia neck often leads to missed endoscopic detection [12].

In patients with linear gastric erosions or ulcers associated with a paraesophageal hernia, surgical indications include massive GI hemorrhage, failure of ulcer to heal, or recurrent ulceration [13]. Typically medical treatment for Cameron ulcers is initiated first, beginning with high-dose PPIs and iron supplementation, with surgery reserved for patients who fail medical therapy [12, 14]. Early elective surgical intervention is also recommended in high-risk patients on steroids or NSAIDs with medically refractory ulcers. Paraesophageal hernia repair has also been associated with improved outcomes in patients with chronic anemia [9, 15–17]. In one study of 77 patients with giant paraesophageal hernia, mean hemoglobin level improved from preoperative levels of 9.6–13.6 mg/dL at 1-year follow-up [15]. Similarly, Hayden et al. demonstrated occult bleeding with chronic anemia resolved in 90% of patients after PEHR [17].

Timing of Repair

With no clear existing guidelines or consensus on optimal timing of repair, complicated PEH are often treated on an individual case-by-case basis with management guided by presence of irreversible tissue damage and patient hemodynamic stability [18]. Initial management in patients with acutely symptomatic PEH should always include an immediate attempt at nasogastric tube placement in addition to fluid resuscitation and correction of electrolytes. In cases where the nasogastric tube is unable to be placed, use of endoscopy may facilitate placement of the nasogastric tube and gastric detorsion, as well as enable evaluation for mucosal ischemia [19, 20].

Emergent repair is indicated in patients with hemodynamic instability and need for vasopressor support. Patients with clinical suspicion of gastric necrosis or perforation often present with systemic signs of sepsis and require an immediate operation to obtain source control, while patients presenting with hemorrhagic shock secondary to acutely bleeding ulcers also require emergent surgical intervention, as endoscopic hemostasis is unlikely. Early intervention within 24 hours in patients presenting with acute symptoms has been associated with reduced patient morbidity, including lower rates of postoperative sepsis, pulmonary edema, and shorter hospital length of stay (LOS) [21]. In patients with perforated ulcer associated with PEH, delayed time to surgical treatment has been shown to significantly increase patient mortality with rates reported as high as 60% [22, 23].

Urgent surgery is warranted in patients where nasogastric tube insertion or decompression is unsuccessful due to significant increased morbidity associated with delayed repair [19]. One management algorithm (Fig. 15.1), proposed by Bawahab et al., utilized an upper GI contrast study to determine timing of treatment for clinically stable patients with acute presentation. Failure of contrast passage into the duodenum

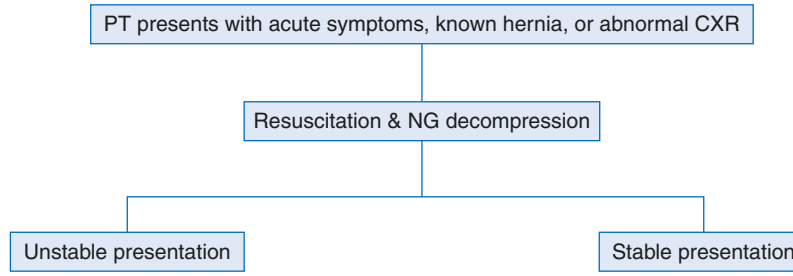

Fig. 15.1 Algorithm from Bawahab et al.

after nasogastric decompression was an indication for urgent repair, while patients who had passage of contrast had their repair delayed to the semi-elective setting within the same hospitalization [18].

In stable patients without evidence of ischemia or perforation, successful nasogastric decompression may relieve partial strangulation and decrease pulmonary aspiration risk, allowing for surgery to be temporarily postponed until the patient is medically optimized [18, 22, 24]. In one study by Kohler et al., patients who underwent semi-elective repair within the same hospitalization had improved outcomes compared to those requiring emergency repair [19]. Similarly, in cases where a surgeon with advanced expertise is not readily available, decompression may allow for transfer to a surgery center with appropriate surgeon expertise in complex foregut surgery.

Surgical Approach

Laparoscopy is increasingly considered the preferred approach for urgent or emergent cases, and in one recent analysis of surgeon practices, 70% of urgent/emergent PEHR were performed laparoscopically [25]. The majority of strangulated PEH in stable patients can be repaired laparoscopically, with established safety and efficacy [26, 27]. For surgeons with experience in complex laparoscopic foregut surgery including antireflux procedures, Schiergens et al. also support its use as the initial surgical approach for stable patients with ischemia or perforation [28]. Additionally, in experienced hands, laparoscopy has been established as an efficacious approach for patients with acutely bleeding ulcers [27, 29].

Compared to the traditional open surgical approach with mortality rates previously reported as high as 56%, laparoscopic repair is associated with reduced patient morbidity, including respiratory complications, decreased pain, and shorter LOS [30, 31]. Comparing transthoracic and transabdominal open approaches, available data does not demonstrate a mortality difference between transabdominal and transthoracic approaches, but morbidity is felt to be higher with a transthoracic approach [32].

Other advantages of laparoscopic approach include better visualization of the hiatus and mediastinum that largely facilitates esophageal mobilization and ease of performing a fundoplication [33]. As such, concomitant antireflux procedure in the urgent/emergent setting is more commonly performed with laparoscopic approach compared to open, likely reflecting improved patient stability and ease of access with laparoscopy [25].

However, a low threshold for conversion to laparotomy should be maintained, particularly in damage control settings [34, 35]. An open surgical approach remains the recommended approach for unstable patients and is recommended for surgeons lacking adequate laparoscopic expertise [6, 18, 28, 36]. Other contraindications to laparoscopic approach include patient inability to tolerate pneumoperitoneum, and gross peritoneal or mediastinal contamination. In patients with persistent hemodynamic instability, consideration should be given to a damage control operation, with definitive repair postponed until the patient is clinically stable.

Comparisons of open transthoracic and transabdominal approaches have demonstrated similar recurrence rates after PEHR, and thus, preferred

approach is largely based on surgeon preference [11]. Advantages of the open transthoracic approach include superior access for mobilization of the esophagus and ability to create a tension-free repair [37]. In rare situations where maximum exposure is required, a left thoracoabdominal incision can be performed, although it is associated with significant pain and morbidity [38]. Although a left thoracotomy incision may be preferred in patients with a hostile abdomen, a transabdominal approach via laparotomy incision may enable detorsion of gastric volvulus or reduction of an obstructed, distended stomach. Additionally, in cases with a high index of suspicion for perforation, pleural or mediastinal contamination significantly increases risk of respiratory complications including pneumonia, empyema, and mediastinitis. Thus, laparotomy often is the preferred approach over thoracotomy for patients with suspected ischemia or perforation. Disadvantages of laparotomy include difficult access to the mediastinum and diaphragmatic hiatus, especially in obese patients.

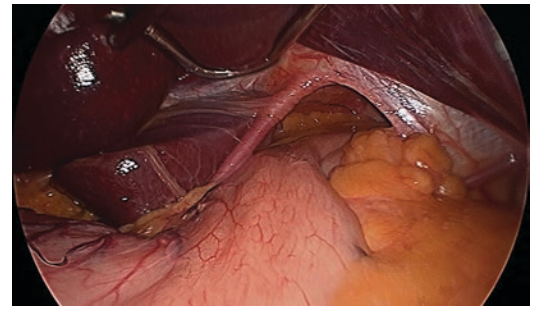

Fig. 15.2 Paraesophageal hernia

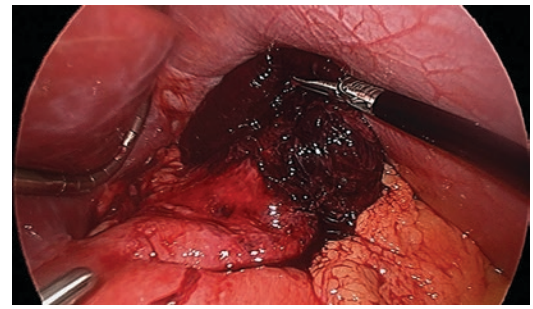

Fig. 15.3 Ischemic fundus in traumatic diaphragmatic hernia

Operative Management

Unlike optimal repair techniques described in the elective setting, the primary operative goals of complicated PEHR center on hernia reduction, relief of acute obstructive symptoms, and resection of ischemic tissue [11, 37]. Surgical treatment begins with attempted reduction of the migrated stomach to its intra-abdominal position and assessment for tissue viability (Fig. 15.2). Prolonged venous compression can result in thrombosis of the mesenteric vessels, resulting in irreversible tissue damage after restoration of circulation [36]. In cases where gastric necrosis or gangrene is present, limited gastric resection of ischemic areas is warranted [6] (Fig. 15.3). Wide drainage is critical for source control particularly in patients with gross contamination, perforation, or devitalized tissue. These cases can be approached from a laparoscopic, transabdominal, or transthoracic approach. The benefits of laparoscopy are similar to those in uncomplicated cases; however, familiarity with foregut anatomy and minimally invasive techniques is paramount, as the anatomy and visualization may be distorted from any contamination.

Techniques for Repair

Regardless of surgical approach, techniques for successful definitive PEHR are aimed at reducing hernia recurrence and include reduction of the hernia sac and herniated organs, esophageal mobilization (Fig. 15.4), hiatal cruroplasty (Fig. 15.5), and intra-abdominal fixation of the migrated stomach using tailored fundoplication or gastropexy. Additional surgical maneuvers including Collis gastroplasty and prosthetic mesh reinforcement (Fig. 15.6) are also performed as necessary to reduce axial and radial tension forces on the hiatal repair. Closure of the hiatus is performed using permanent suture and may include a combination of anterior (Fig. 15.7) and posterior crural sutures (Fig. 15.5). In patients with large hiatal defects where reapproximation of the

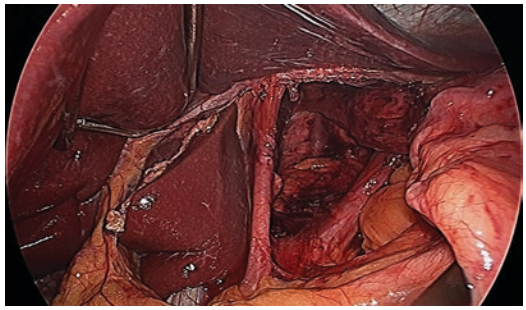

Fig. 15.4 Standard paraesophageal hernia after mediastinal dissection and reduction of hernia sac

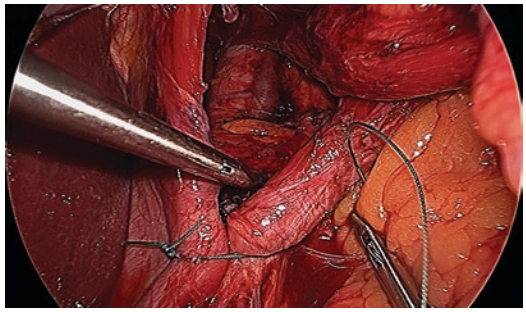

Fig. 15.5 Sutured closure of hiatus

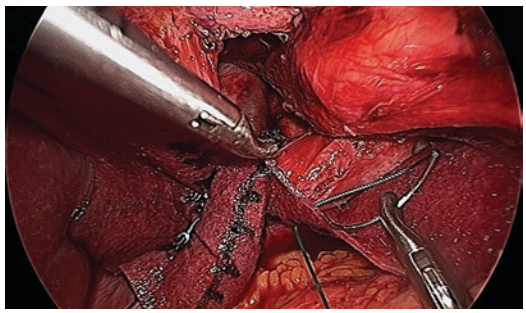

Fig. 15.6 Mesh reinforcement of hiatus, mesh secured simultaneously with hiatal closure using horizontal mattress sutures

crura is difficult, a diaphragmatic relaxing incision can also be performed to reduce excessive radial tension [39]. Most surgeons typically start with relaxing incisions in the right diaphragmatic crus; however, a left diaphragmatic relaxing incision can also be performed if crural mobilization is insufficient [40].

Following relocation of the stomach to its correct intra-abdominal position, a tailored fundoplication is often performed during PEHR, particularly in patients with preoperative symptoms of reflux [8]. Some believe that a fundoplication helps anchor the newly reduced stomach below the diaphragm, and other benefits of fundoplication include restoring LES competency and reducing postoperative reflux symptoms, with one study reporting abnormal esophageal acid exposure in 39% of patients without fundoplication [41]. In patients with foreshortened esophagus, addition of a Collis gastroplasty can increase the length of the intra-abdominal esophagus, reducing axial tension on the repair and risk of hernia recurrence [39]. However, the benefits of fundoplication should be weighed against the potential risks of gastroplasty staple line leak and ischemic stricture, particularly in unstable patients with reduced mucosal perfusion. Additionally, performance of a fundoplication prolongs the duration of surgery and general anesthesia, which can pose significantly detrimental consequences in elderly or frail patients with reduced cardiovascular reserve. In one study evaluating laparoscopic PEHR in elective and emergent settings, Parker et al. observed significantly fewer fundoplications and shorter operative times in acutely symptomatic patients [26]. In frail or debilitated patients with insufficient length of intra-abdominal esophagus after mobilization, gastrostomy tube placement is often performed to allow for postoperative decompression and enteral feeding access.

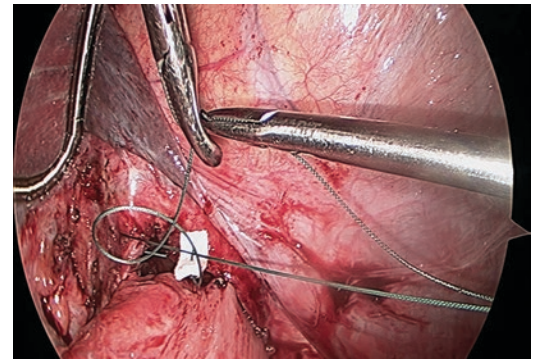

Fig. 15.7 Anterior hiatal closure can be performed when necessary. Pictured: hiatal hernia repair after prior esophagectomy. Anterior hiatal closure can avoid unnecessary risk to gastric conduit blood supply, as long as hiatus is amenable to anterior closure

Hernia sac dissection and excision remains a controversial topic in PEHR. Dissection of the hernia sac off the crura and mediastinum helps in restoring intra-abdominal configuration of the stomach, while hernia sac excision allows for improved esophageal mobilization and better performance of concomitant antireflux procedure [8, 11]. One study of elective PEHR demonstrated an association between failure of hernia sac excision with increased early PEH recurrence in 20% of patients within the first 2 months [42]. However, mediastinal dissection of the hernia sac is technically challenging in large, chronic PEH due to fusion of the sac to surrounding structures and associated with increased risk of iatrogenic injuries including damage to the vagal nerves [11]. Unlike patients who undergo elective PEHR, excision of the peritoneal hernia sac is not recommended in the context of ulcer perforation or necrotic tissue given the risk of pleural and mediastinal contamination [43]. Partial sac excision may reduce the potential morbidity of an intraoperative injury and be a feasible alternative in high-risk or frail patients with limited physiologic reserve [44].

Prosthetic mesh for hiatal reinforcement has also been described as an adjunct for PEHR in the elective setting, particularly in patients with large hiatal defects [39, 45, 46]. However, the use of synthetic mesh for complicated PEHR is generally not recommended, particularly in the contaminated settings of necrosis and perforation given the increased risk of infectious complications and subsequent abscess formation [47, 48]. Biologic meshes have been used in contaminated settings and have been associated with reduced short-term recurrence; however they may not significantly affect long-term recurrence rates [49].

In patients with ulceration, therapeutic endoscopy is rarely successful in achieving hemostasis, although one study by Lin et al. described the successful use of endoscopic band ligation in a patient with life-threatening hemorrhage [50]. The need for definitive ulcer treatment in addition to PEHR is also controversial. While some surgeons advocate for definitive ulcer treatment including gastric resection or vagotomy and drainage [13], others have suggested that ulceration results from erosion of the hernia sac and consequently is resolved by PEHR alone [43]. In the largest study of hiatal hernia related ulcers, Boyd et al. observed a poor response to medical treatment with improved ulcer resolution after surgical treatment [51].

Perforations associated with hiatal hernia can manifest as a contained perforation within the lesser sac or result in free peritoneal contamination causing diffuse peritonitis. Surgical management differs slightly from strangulated PEH or non-perforated ulceration. The primary operative goal is to obtain source control with resection of nonviable tissue and wide drainage. After irrigation and excision of devitalized tissue, repair or formal resection of the perforated area is performed. Various surgical techniques for management of perforation have been described, including partial gastrectomy using a linear stapler for larger perforations [52] and double-layered omental patch repair for smaller perforated ulcers [47]. In addition to omental buttresses, the use of fundoplication using the mobilized stomach to reinforce the gastrotomy repair has also been reported [43].

The role of definitive PEHR in the emergent setting is largely based on surgeon expertise as well as patient's clinical presentation and operative findings. Pol et al. reported a patient with perforated prepyloric ulcer associated with a paraesophageal hernia who underwent an omental patch repair and intrathoracic drainage given their septic presentation [47]. Although the hiatal hernia was identified, the surgeons elected not to perform a herniorrhaphy or mesh repair of the hiatus given the anticipated risk of infection and subsequent abscess formation.

Damage Control Versus Definitive Care

Given the high acuity of complicated PEH patients and technical complexity of surgical repair, the role for definitive management in this setting remains controversial. As such, options for damage control surgery for patients with complicated PEH can be temporizing and life-saving in

settings where patient comorbidities or surgeon expertise may prohibit definitive repair.

Damage control strategies for complicated PEH largely focus on reduction of herniated organs, debridement of necrotic tissue, and closure of perforated viscus. Others have also described excision of devitalized tissue at the perforation site with placement of a Stamm gastrostomy tube to provide anterior abdominal wall fixation and means for decompression or enteral access [43]. In patients requiring resection of nonviable esophageal or gastric tissue, partial esophagogastrectomy with proximal diversion and placement of distal feeding access can be performed urgently, followed by planned delayed reconstruction. Similarly, patients can undergo immediate hernia reduction with definitive PEHR delayed to a semi-elective or elective setting.

Anterior gastropexy is another technique used in the damage control setting to help anchor the stomach in its intra-abdominal location and is often described in high-risk patients as an alternative means to fundoplication [53–56]. Higashi et al. described the safety and efficacy of hiatal repair with laparoscopic anterior gastropexy in elderly patients with PEH and reported minimal perioperative complications [53]. Gastropexy alone without diaphragmatic hiatus closure has also been described as a salvage technique, although high recurrence rates should be expected in this setting, with one study reporting 23% recurrence within 3 months [57]. Gastropexy can be performed using suture fixation, T-fasteners, or with gastrostomy tube placement in patients also requiring enteral feeding access [44, 53, 54]. When anterior gastropexy is performed, the authors routinely place three transfascial sutures along the greater curve of the stomach (Figs. 15.8, 15.9, 15.10, 15.11, and 15.12). The stomach is drawn up to the abdominal wall with decreased laparoscopic insufflation to identify the appropriate location for gastropexy sutures (Fig. 15.8). Permanent sutures are then placed with seromuscular bites, careful to avoid mucosal entry (Fig. 15.9). Both ends of each suture are then drawn through the abdominal wall individually using a suture passer (Fig. 15.10). The sutures are not tied until the end of the procedure. After all three sutures are placed (Fig. 15.11), endoscopy is used to confirm no mucosal penetration of the sutures, in hopes of avoiding gastric fistula. The sutures are then drawn taught (Fig. 15.12), confirming appropriate location and orientation of the sutures. When the procedure is complete, the abdomen is desufflated, and the sutures are tied. Excessive tension with knot tying is avoiding in

Fig. 15.8 Assessing appropriate position of gastropexy sutures along greater curve

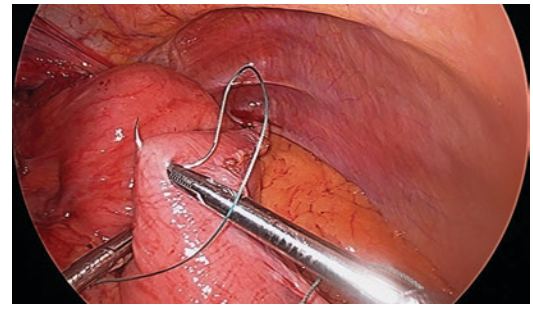

Fig. 15.9 Interrupted gastropexy suture (endoscopy performed to ensure suture is not full thickness)

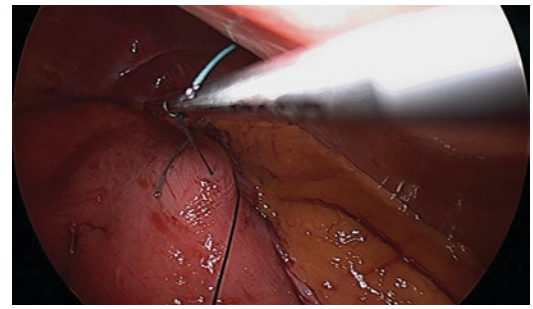

Fig. 15.10 Suture passer used to draw each end of suture through transfascial stab incision

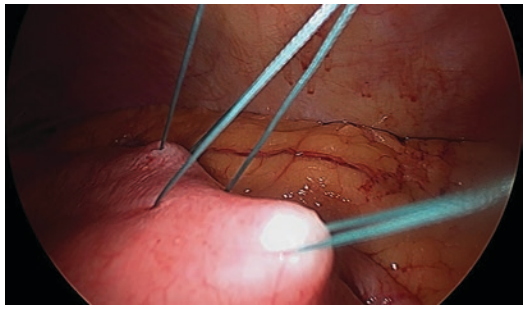

Fig. 15.11 Three permanent gastropexy sutures placed

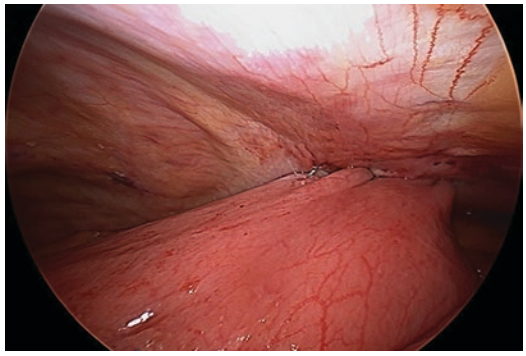

Fig. 15.12 View from right upper quadrant demonstrating suture position prior to tying transfascial sutures

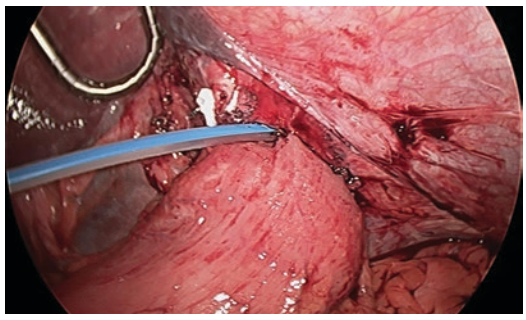

Fig. 15.13 The authors routinely leave a mediastinal drain in elective and emergent paraesophageal hernia repairs. This can drain seromas and also be used to monitor drain fluid for amylase to detect leak. Pictured: hiatal hernia repair after prior esophagectomy

hopes of preventing local ischemia from the gastric compression by the knot.

Placement of a surgical or percutaneous endoscopic gastrostomy (PEG) should also be considered in elderly or debilitated patients with foreshortened esophagus as an alternative to Collis gastroplasty. In such patients where risk of delayed gastric emptying is high, gastrostomy tube provides means for gastric decompression and enteral access. In the damage control, emergent, or elective setting, the authors routinely place drains. In the elective setting, a mediastinal drain can prevent or reduce seroma formation. In the emergent or damage control setting, drain fluid can be tested for amylase to detect a leak (Fig. 15.13).

Summary

In patients with paraesophageal hernias, acute presentation with intractable obstructive symptoms, systemic sepsis, or hemodynamic instability raises clinical suspicion for dreaded complications of hemorrhage, strangulation, necrosis, or perforation. Emergent surgery is required, and early intervention has been shown to improve postoperative outcomes. In clinically stable patients with successful nasogastric decompression, repair can be temporarily delayed to a semi-elective setting allowing for medical optimization or transfer to centers with advanced laparoscopic expertise. Initial operative management should include reduction of herniated organs and resection of ischemic or devitalized tissue. Perforations should be repaired or formally resected, with appropriate drainage. In unstable patients, options for damage control include delaying enteral reconstruction or definitive PEHR until patients can be stabilized. Use of anterior gastropexy and gastrostomy tube placement can be life-saving alternatives to fundoplication and Collis gastroplasty in poor surgical candidates, including medically frail patients.

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