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On the Lap repair of paraesophageal hernia and gastric volvulus

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Abstract:

A decision for Surgery is based on symptoms. Most cases are minimally symptomatic, or have no symptoms, and those patients do not necessarily require surgery. However, in the young patient, under the age of 60, one should consider surgery, even in the minimally symptomatic patient. Conversely, in the elderly patient greater than 80, with significant comorbidities, one might consider watchful waiting in the minimally symptomatic. However, patients with symptoms, usually dysphagia, postprandial epigastric or chest pain, or vomiting should be considered for surgery unless there are significant comorbidities. In the subset of patients with symptoms, but significant comorbidities, where watchful waiting is adopted, surveillance should be undertaken with follow up every 6 to 12 months and monitoring of symptoms. As symptoms escalate, the chance of a more acute event is possible, and therefore the risk benefit equation changes despite the presence of comorbidities.

The Repair of hiatus hernia is laparoscopic in the vast majority of cases and can be complex and difficult requiring a high level of skill for paraesophageal hernias and gastric volvulus.

The principles of surgery include:

1/ dissection and excision of the hernia sac
2/ Reduction of the stomach into the abdomen with sufficient esophageal length
3/ secure closure of the crura with adequate reinforcement
4/ fundoplication (usually Toupet)
5/ fundoplication reinforcement
6/ gastropexy

Key Words:

Hiatal Hernia, Paraesophageal Hernia, Gastric Volvulus, Laparoscopic

Introduction

Hiatus hernia is common in the general population. One county in Sweden estimated the prevalence of hiatal hernias as high as 68%[1], but other estimates in western populations range from 10% to 20%[2,3] in the general population, and as high as 60% in those above age 50[4]. In most cases hiatus hernia develops gradually, associated with the physiological and physical changes that occur with age, and will slowly progress in both size and characteristics of the hernia in most patients[1]. Although predicting the natural history of a hiatus hernia in any one patient over time is virtually impossible, the tendency will be for sliding hiatus hernias to become larger, and many will progress to become paraesophageal hernias. Likewise, paraesophageal hernias will also tend to gradually increase in size over time, and many will ultimately involve much or all of the stomach, at which point they are termed gastric volvulus[1]. In a recent single institution study that followed 55 patients with sliding hiatus hernias over a period of seven to eight years, the size of sliding hiatus hernia increased in 30 patients (55%) during that time, while 14 (25%) of the patients had their sliding hiatus hernia progress to become a paraesophageal hernia. Likewise, of the 13 patients who started the study with a

paraesophageal hernia, 8 patients (62%) increased in size during the study period[1].

The classification of hiatal hernias is classically divided into four types. Type 1 Hernias, otherwise known as "Sliding" Hiatal Hernias, involve displacement of the gastroesophageal (GE) junction into the mediastinum. Type 2 Hernias, otherwise known as the "Paraesophageal Hernia", occur when part of the stomach migrates into the mediastinum parallel to the esophagus. Type 3 Hernias occur when both the GE Junction and stomach have migrated into the mediastinum. Finally, Type 4 Hernias occur when the stomach and an additional organ (i.e. the colon, small intestine, spleen, etc.) herniate into the mediastinum. For a visual depiction of the different types of hiatal hernias, please refer to Figure 1.

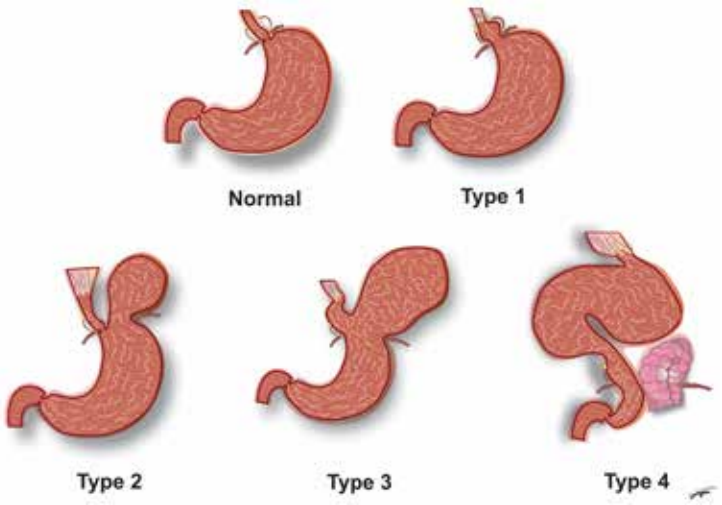


Figure 1: Characteristic Classification of Paraesophageal Hernias

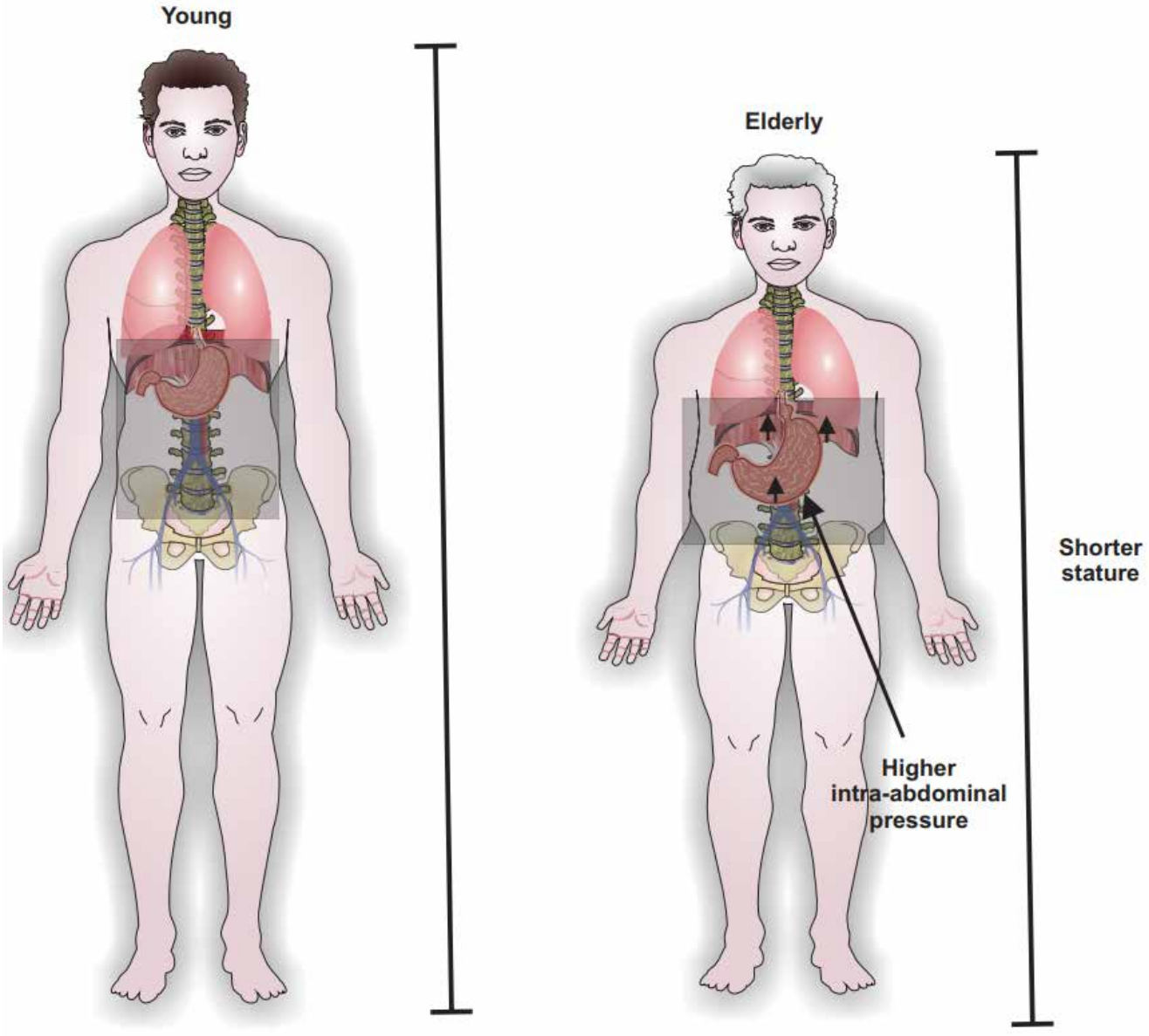
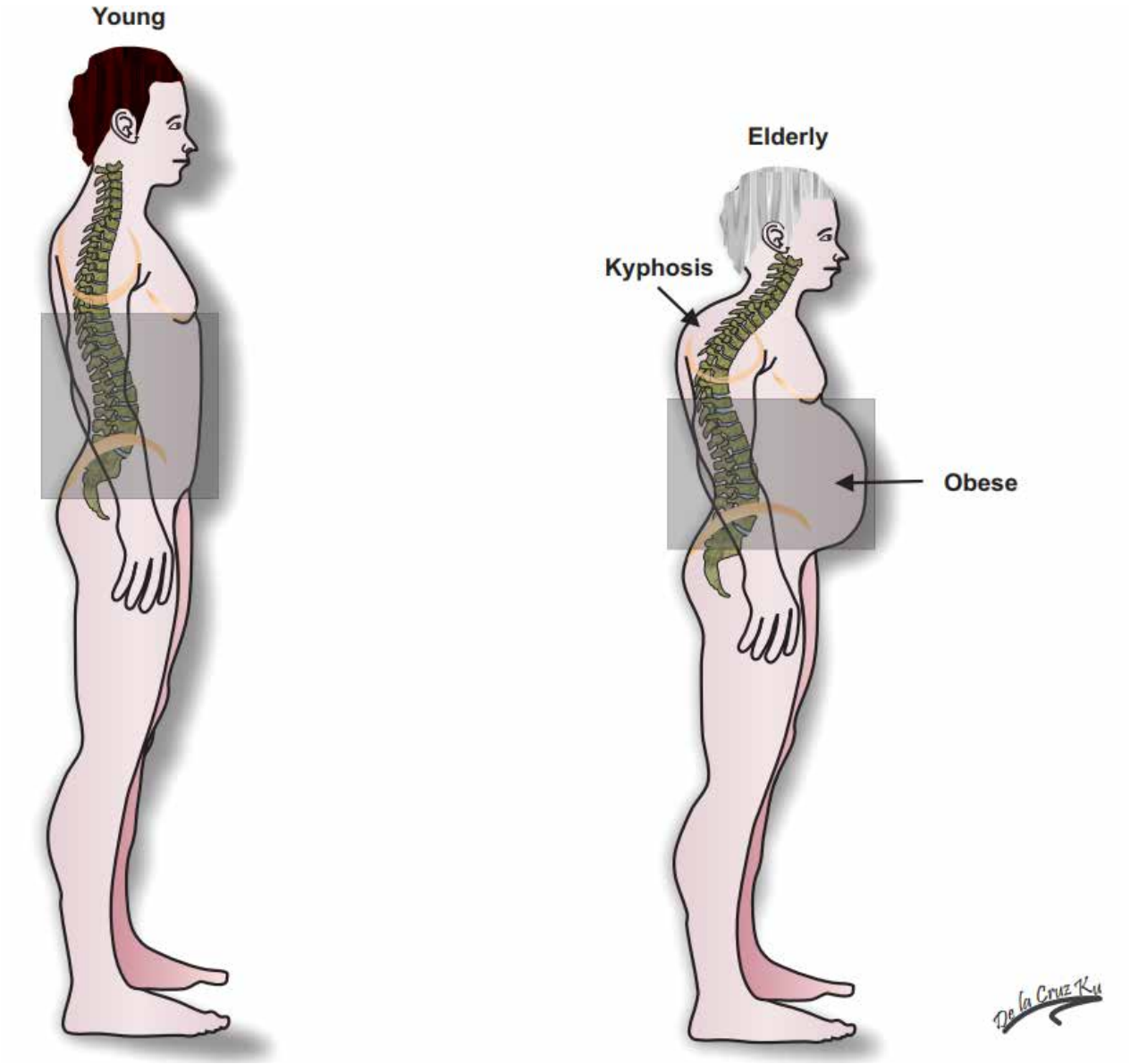


Figure 2: Natural Progression of Hiatus Hernia



Physiologic and physical changes that occur with age undoubtedly contribute to the formation of hiatus hernia and the progression over time. Age related degeneration of connective tissue is well documented[5],[6] and will lead to musculoskeletal changes including loss of intervertebral disc height and progressive kyphosis[7]. Likewise, increasing dilation and enlargement of the esophageal hiatus occurs with age[8]. These factors, coupled with weight gain and increasing abdominal girth usually seen in aging[9], contribute to increased intra-abdominal pressure that leads to progressive herniation of the stomach into the chest. The concept of the abdomen being a contained space in which pressure increases with patient age is illustrated in Figure 2. Logically, it would follow that the prevalence of hiatus hernia would increase as the population ages and obesity becomes endemic[10].

1. If one considers the abdomen to be a contained space, that space will get smaller and the contents of that space will increase over time with increasing age.

2. The contents of the abdomen will increase due to weight gain increasing mesenteric and omental fat, and the intraabdominal compartment will get smaller due to loss of height with age (intervertebral disc narrowing) and progressive kyphosis.

3. With dilation of the crural opening, the stomach will gradually migrate up into the chest.

Other theories on hiatal hernia development exist, including the common assertion that increased tissue laxity with age allows the gastroesophageal junction and upper part of the stomach to remain elevated in the chest after the completion of the swallowing mechanism[4],[11], but these theories are not as compelling.

Paraesophageal Hernias and Gastric Volvulus

Paraesophageal hernias and gastric volvulus can occur as either acute or chronic conditions. Acute symptoms with impending gastric ischemia requires urgent surgery[12]. However, the vast majority of patients have mild symptoms, or are even asymptomatic at the time of their presentation[4]. In our practice, many patients have been referred because of an incidental finding of a paraesophageal hernia or gastric volvulus on a CT scan performed for another reason. Therefore, many patients referred for paraesophageal hernia and gastric volvulus are minimally symptomatic or asymptomatic. Further, they are usually elderly, and many have significant comorbidities. As a result, many referred patients will not require surgery since the benefit of surgery does not outweigh the risk. They should be followed, and if symptomatology increases, they should then be re-considered for an operation. On the other hand, younger patients under the age of 60, who are without any major health problems, should probably have surgery to treat their hernia, even if it is minimally symptomatic or asymptomatic. Patients in between these two subgroups need to be carefully evaluated with treatment being individualized after carefully balancing the risk of the hernia, the patient's quality of life related to the hernia, and the risks of surgery, including both short- and long-term complications.

The majority of patients requiring surgery are the following: They have mild to moderate symptoms of dysphagia or epigastric pain after eating which significantly affects their quality of life and their risks of surgery are not prohibitive. These patients will want surgery to improve their quality of life. A smaller subset of patients will have severe symptoms and/or rapidly escalating symptoms, and therefore are at much higher risk for having an acute event, and should have surgery.

Surgical Approach

Traditionally, repair of hiatal hernias was performed open, through a thoracotomy or laparotomy. However, multiple studies have demonstrated shorter hospital stays, decreased pulmonary complications, faster recovery, and similar recurrence rates with the laparoscopic approach[13–15]. Recent studies comparing the laparoscopic approach to the robotic-assisted approach have found similar complication rates, length of stay, and recurrence rates, with mixed results on costs and rates of conversion to open surgery[16,17]. Our group performs the repair laparoscopically once a decision to operate has been made,

Like all surgical operations, meticulous surgical technique and a defined strategy to approach the problem are essential. Because the mechanical factors that cause the hernia in the first place are still present, recurrence of the hiatus hernia is not uncommon. Secure closure and reinforcement of the dilated esophageal hiatus, generous mobilization of the esophagus, creation of a fundoplication to create bulk at the esophageal hiatus, and gastropexy are all strategies to try to prevent recurrence.

Surgical principles

Once a decision to operate has been made, our group performs the repair laparoscopically. The operation for para esophageal hernia and gastric volvulus is typically much more difficult than the more routine repair of a sliding hiatus hernia and fundoplication for gastroesophageal reflux disease (GERD). A higher level of operative skill and experience is required to successfully carry out these operations, and although many of the principles are similar, there are important differences.

The principles of surgery include:

1/ Dissection and excision of the hernia sac.

In para esophageal hernia and gastric volvulus, a large portion or all of the stomach on initial inspection has herniated up into the chest. Although instinctually the operating surgeon will want to pull the stomach into the abdomen to reduce it, this is difficult to do because it is tethered in the chest. Rather, the goal of the dissection should be to reduce the hernia sac. This is accomplished by separating the sac at the apex of the crura and then extending that dissection over the right and the left crura while at the same time bluntly separating the sac from the mediastinal structures to which it is attached. Once the hernia sac is completely reduced, the stomach will come down into the abdomen with the hernia sac.

2/ Reduction of the stomach into the abdomen with sufficient esophageal length

Once the hernia sac is reduced, the esophagus must be aggressively mobilized in the chest in order to attain sufficient esophageal length. This can be challenging! In this mobilization, some degree of vagal denervation may take place, although it is not intended. To prevent this from happening, one must be careful not to denude the esophagus and to leave sufficient tissue around it. If a short esophagus is present, an esophageal lengthening procedure should be carried out, although this is rarely necessary.

Pneumothorax can occur during this dissection but should not be problematic if the rent in the pleura is of sufficient size, because positive pressure ventilation will continue to inflate the lungs. If the pleural opening is small however, it may act as a flap valve. In this scenario carbon dioxide (CO2) from insufflation may enter the pleural space through a small opening, but when the lungs are inflated, because there is a flap valve very little CO2 gets pushed back out into the abdominal cavity, and this results in a significant pneumothorax (even tension pneumothorax can occur). To prevent that from occurring, the surgeon should make sure there is a big opening in the pleura if the pleura is breeched. This way, CO2 will be pushed out of the pleural space every time the lungs are inflated.

3/ Secure closure of the crura with adequate reinforcement.

The crura tend to be widely separated with para esophageal hernia and gastric volvulus. As a result, bringing them together is usually associated with significant tension. Strategies such as the use of pledgets, a U stitch in order to distribute tension, and the use of relaxing incisions have all been advocated. Whereas these are all reasonable strategies, I have migrated to the routine use of biologic mesh in order to reinforce the crural closure.

4/ Fundoplication (usually Toupet)

In general, since this is usually an elderly population of patients, I make the presumption that they have underlying esophageal dysmotility. Many of these patients will suffer from dysphagia. Some have reflux symptomatology. I typically perform a Toupet (posterior 270°) fundoplication in order to prevent reflux in the future, minimize the risk of dysphagia with fundoplication and to provide bulk at the GE junction to help minimize recurrence.

5/ Fundoplication reinforcement

I have recently elected to reinforce the fundoplication with biologic mesh in the hopes of making the fundoplication much more permanent.

6/ Gastropexy

In almost all cases I perform a gastropexy in order to minimize the opportunity for hernia recurrence. By tethering the fundus of the stomach to the anterior abdominal wall in its normal anatomic position I'm hopeful that the fundus will not re-herniate.

When performing a laparoscopic repair of a paraesophageal hernia, there are several key technical considerations:

Trocar Positioning

The RUQ port is utilized for liver retraction. The high epigastric port and the left upper quadrant port are the principle dissecting ports. The supraumbilical port is used for visualization and the left lower paramedian port is used for retraction.

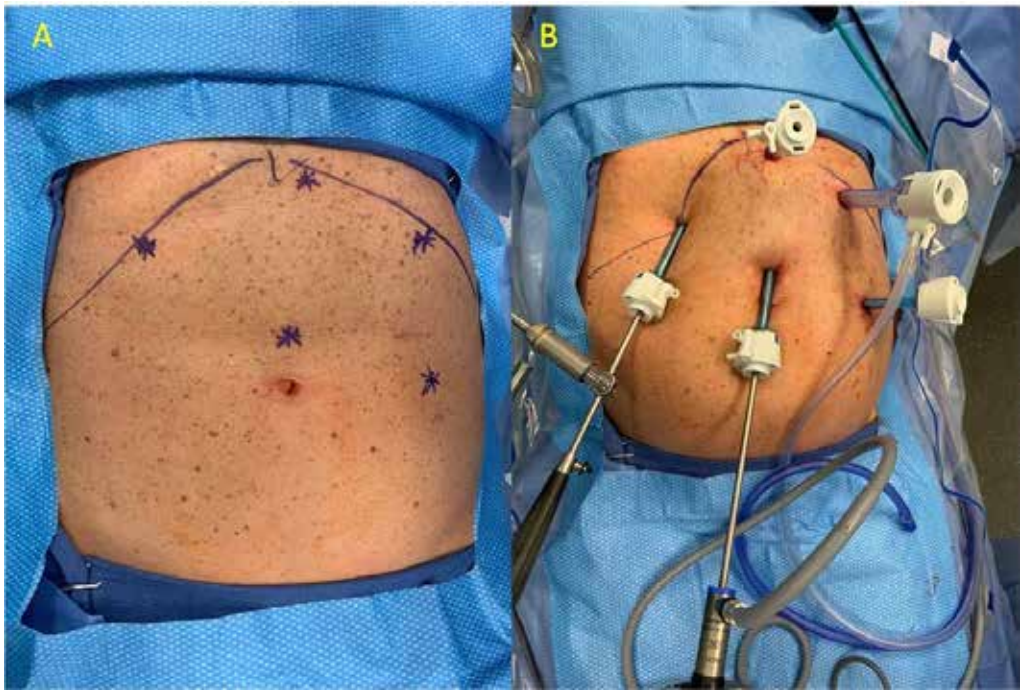


Figure 3: (A) Preoperative planning of port placements **(B)** Ports placed with Nathanson liver retractor and laparoscopic camera inserted

Intraoperative Details

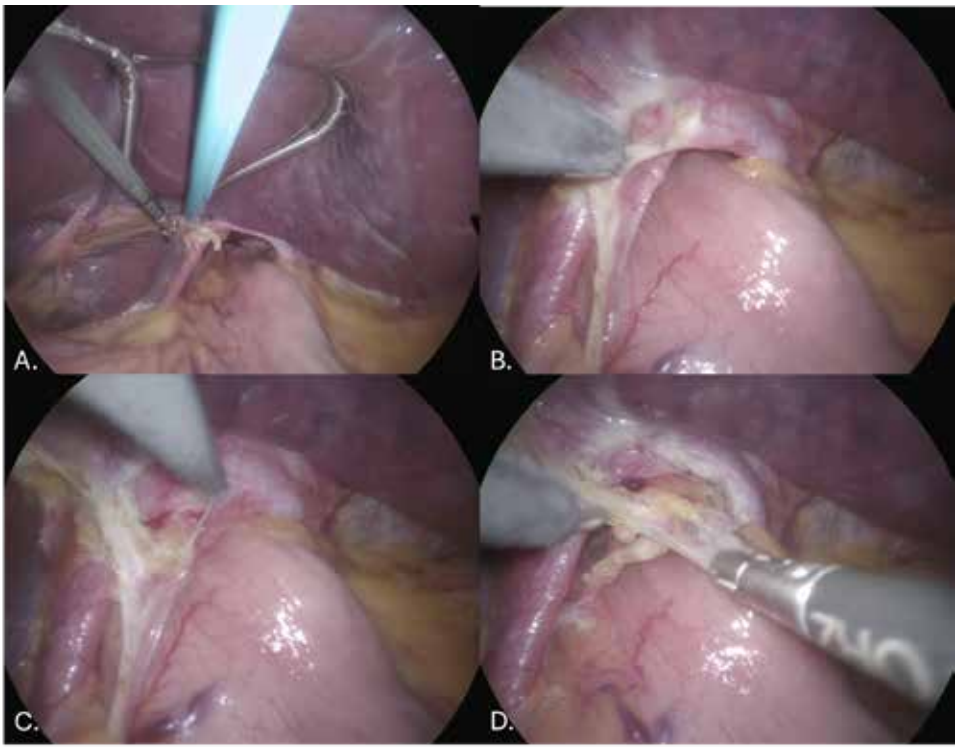


Figure 4: A wide-open esophageal hiatus is typical in para-esophageal hernia and gastric volvulus (Image A). The operation starts with mobilization and reduction of the hernia sac. The stomach then comes down with the sac when the sac is brought down into the abdomen. At the apex of the crura, the plane between the muscle and peritoneum is identified by opening the peritoneum (Images B & C). It is then grasped and bluntly dissected from the mediastinal structures to which it is typically quite loosely attached (Image D).

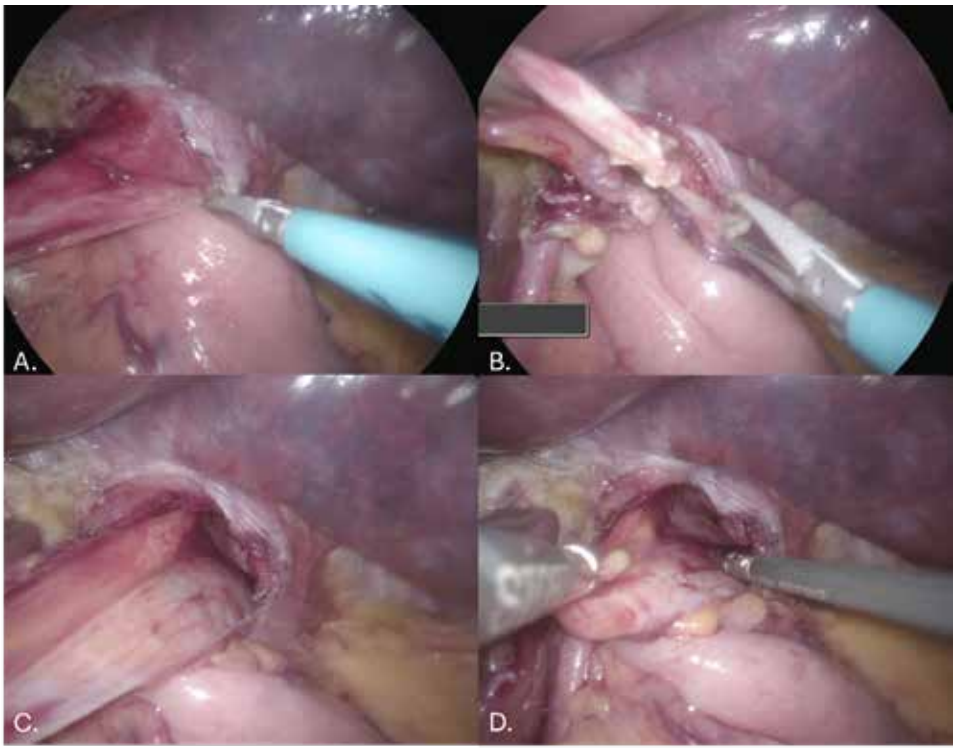


Figure 5: You can see that the sac is being progressively separated from the surrounding attachments (Images A, B, C, & D), as shown here close to the left crus.

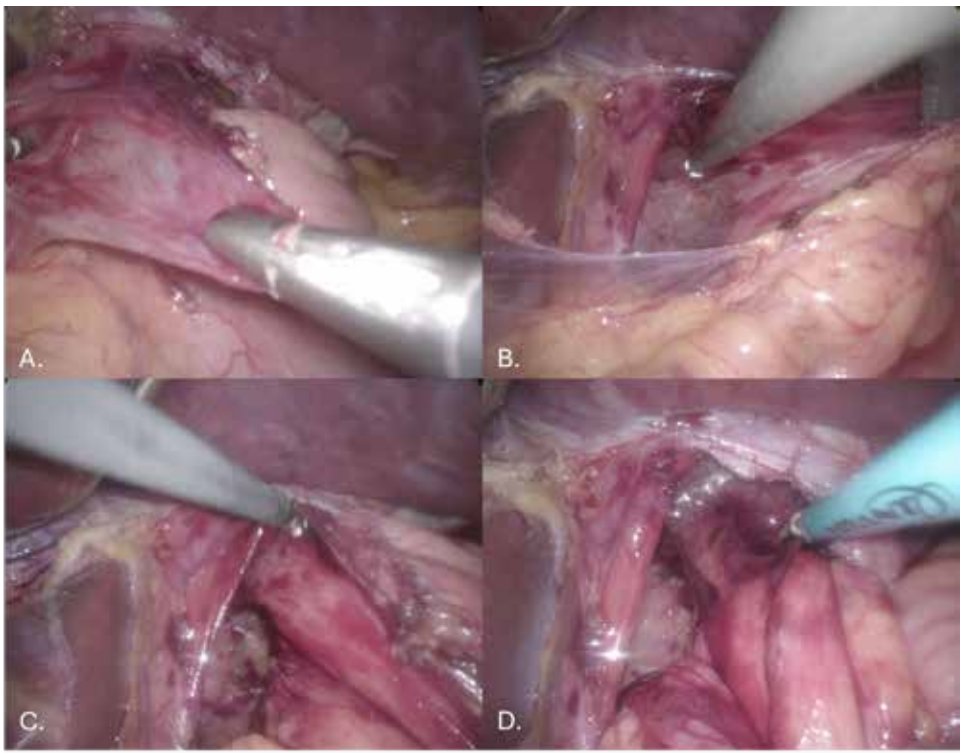


Figure 6: The sac is then mobilized from both the left and the right side, back and forth, until the sac is completely mobilized and reduced into the abdomen (Image A and B). When the sac is significantly reduced, the esophagus comes into view (Image C and D) and will eventually be encircled to facilitate placement of a Penrose drain.

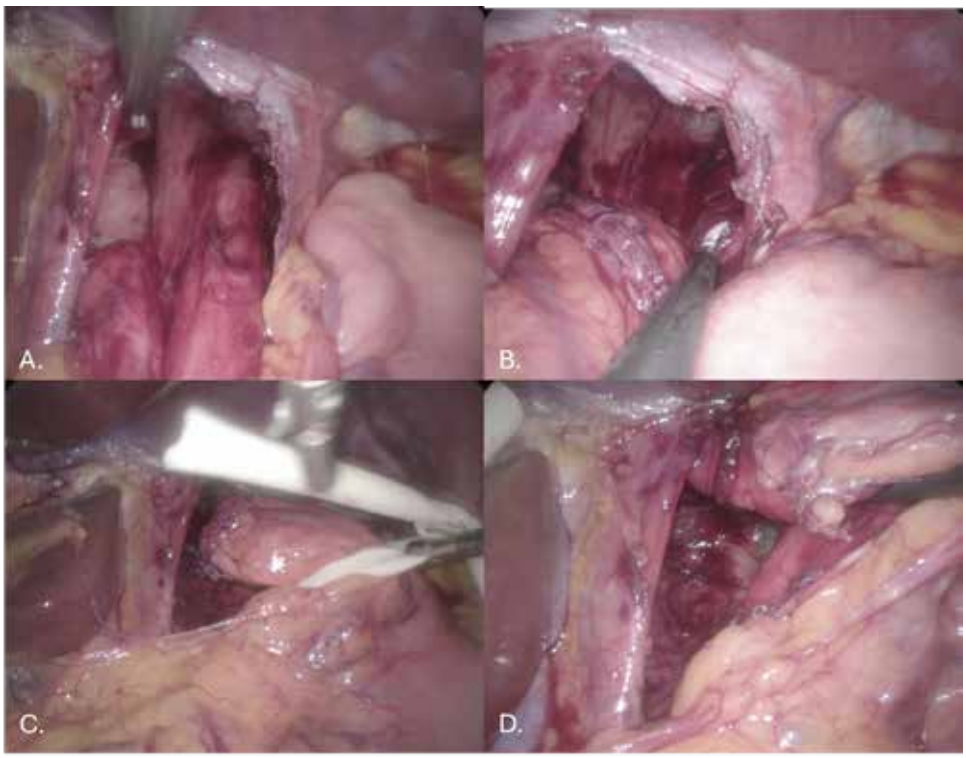


Figure 7: With sufficient mobilization, a Penrose is placed behind the esophagus from the right-hand side of the patient and retrieved then on the left-hand side (Images A & B). With the Penrose in place, traction can be placed on the esophagus allowing for additional esophageal mobilization higher in the chest (Images C & D).

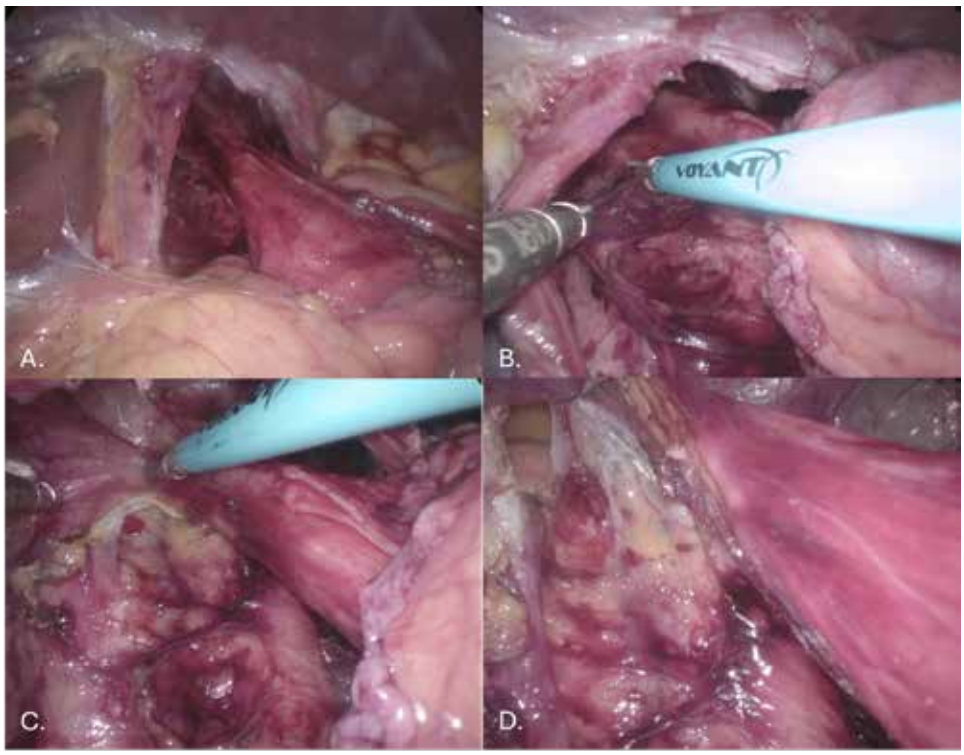


Figure 8: One can see with traction on the esophagus (Image A) that one can freely dissect esophageal attachments high up in the mediastinum in order to obtain sufficient esophageal mobilization (Images B & C). One must be careful not to denude the esophagus by being too close to the esophagus, but if one is too far away one can open the pleural cavity on either the right or left-hand side (Image D).

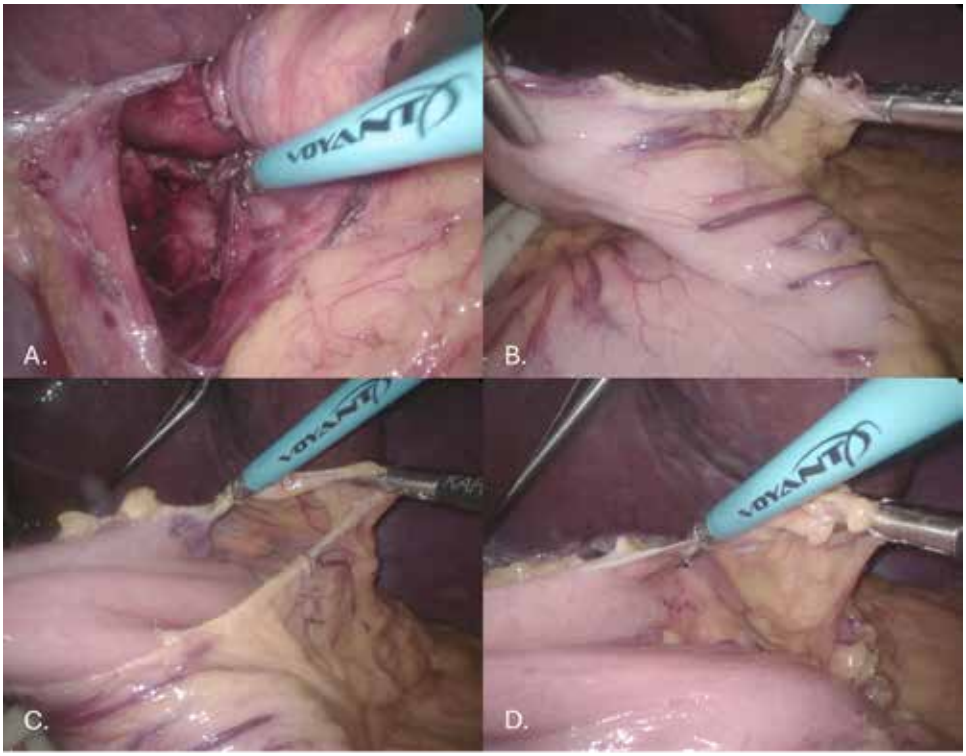


Figure 9: From this approach, one can see that the left crus of the diaphragm is still not completely exposed (Image A). In order to completely separate the sac from the left crus one must divide the short gastric vessels as depicted here (Image B, C, & D) in order to approach the left crus from behind the stomach on the left-hand side.

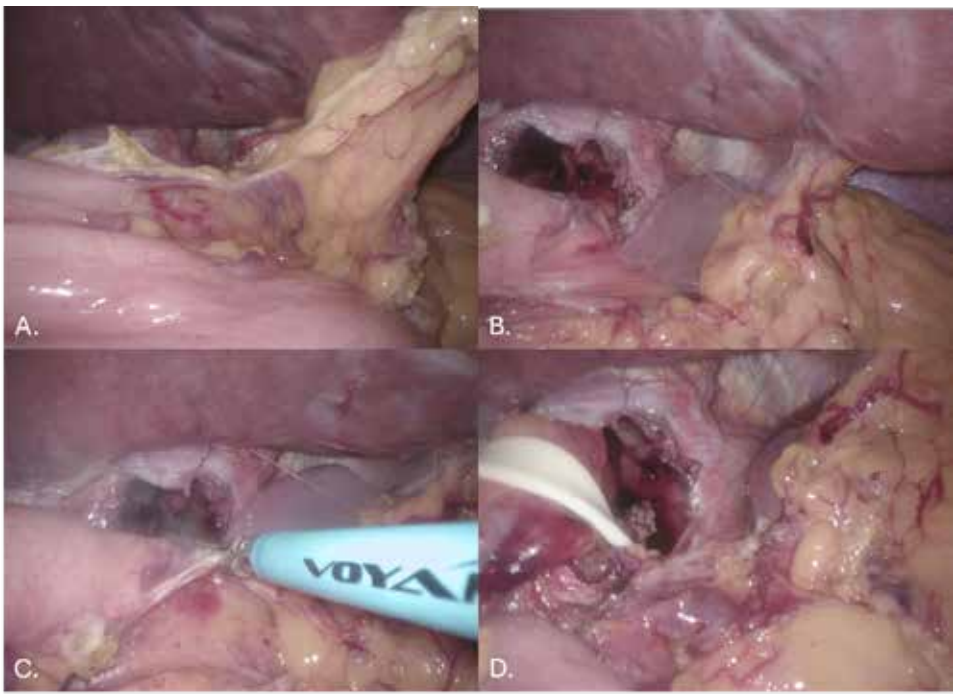


Figure 10: Progressive division of the short gastric vessels up to the level of the left crus exposes the posterior aspect of the stomach overlying the left crus where the hernia sac is still attached (Images A & B) and must be divided (Image C). Once this is done and the left crus is exposed (Image D), the hernia sac is intentionally divided and removed.

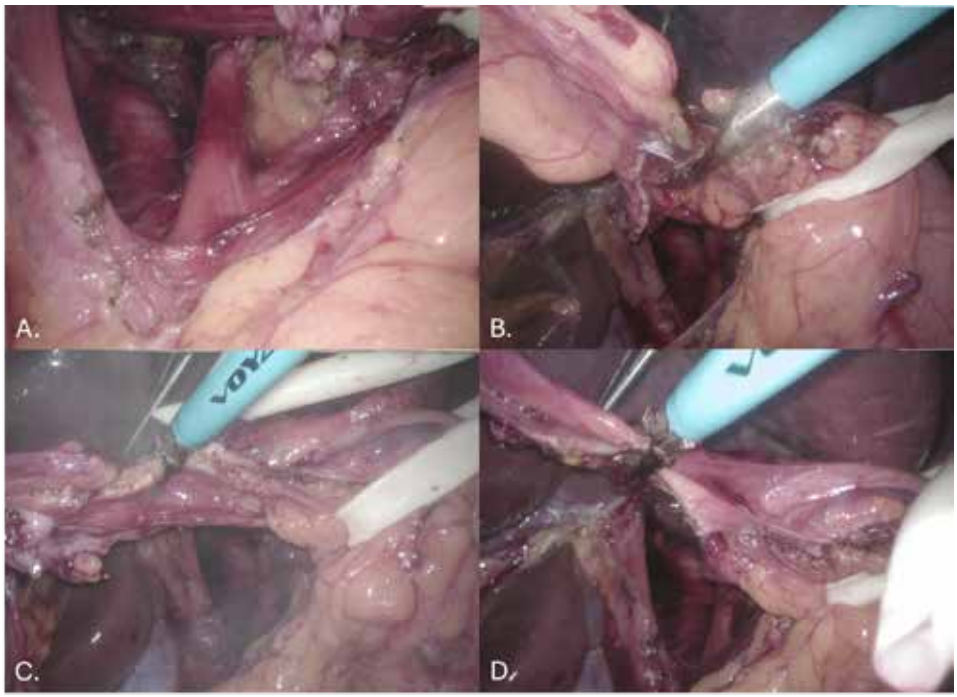


Figure 11: The left crus has been exposed (Image A) and the hernia sac has been reduced. Given the size of the hernia sac in this case, the extra tissue of the hernia sac is subsequently amputated (Images B, C, & D).

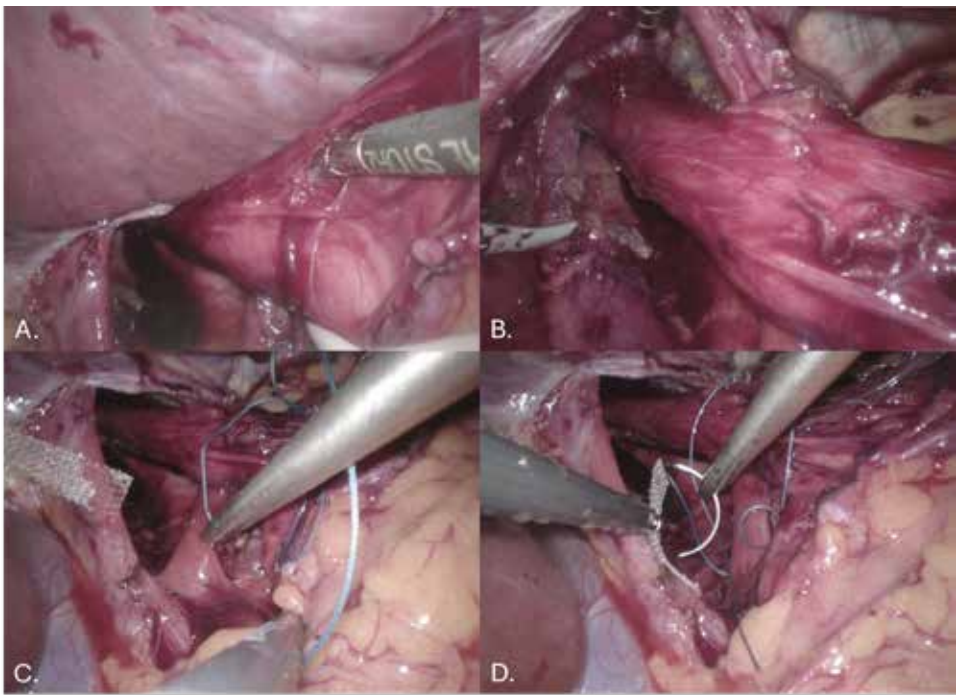


Figure 12: Once the esophagus has been completely mobilized, separation of the sac on the anterior aspect of the esophagus is essential (Image A) since the sac tends to creep up over the esophagus. If it is not separated the actual location of the GE junction may be unclear (Image B), and sufficient bites of the esophagus when creating the fundoplication may not be taken. Here, you can see that the crura are exposed and the crural closure is being undertaken (Images C and D). I use a narrow strip of polypropylene between the crura to try and enhance scarring of the two crura together once the suture is tied (Image D).

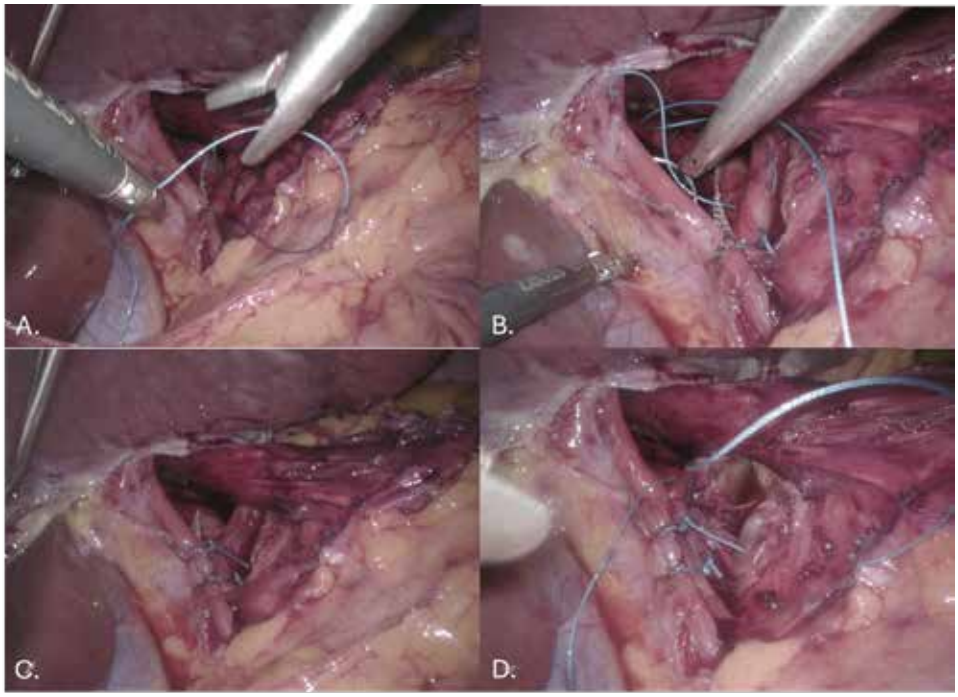


Figure 13: You can see that the crura are being closed progressively with three sutures of 0 Ethibond (non-absorbable) (Images A, B, C, & D).

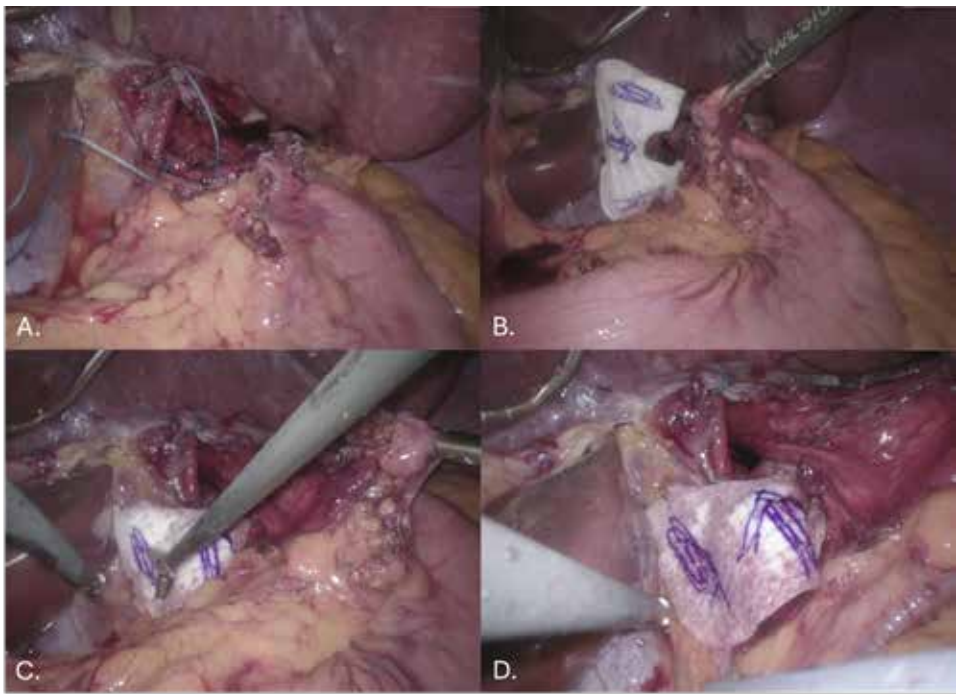


Figure 14: Once the crura are closed (Image A), biologic mesh, in this case Ovitex, is used to reinforce the closure (Images B, C, & D). It is cut to the appropriate dimensions on the back table.

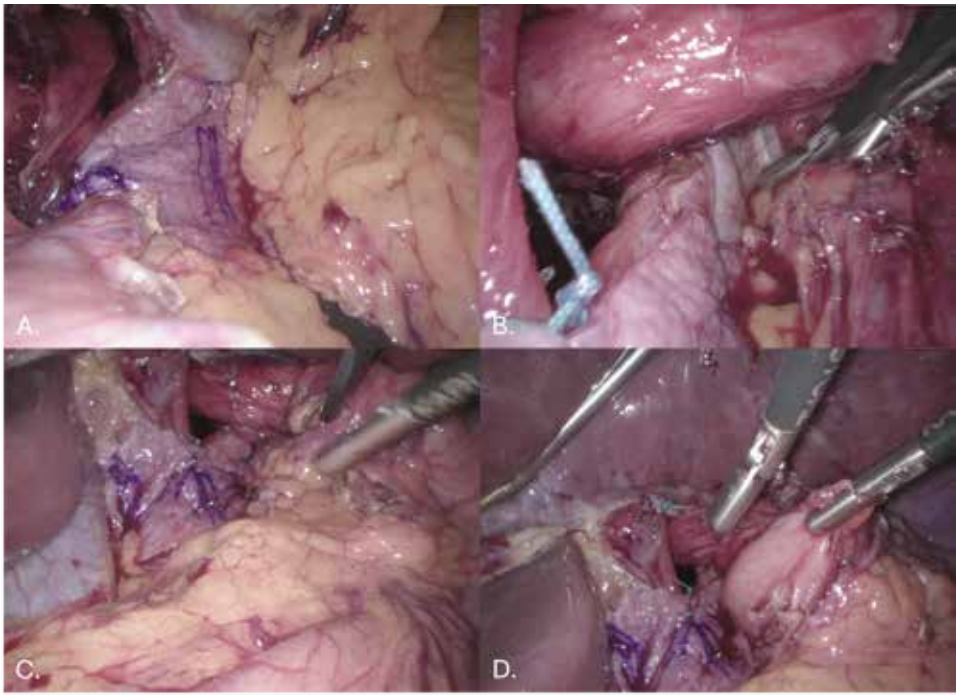


Figure 15: The mesh is then fastened on all sides (Image A) and then fundoplication is carried out (Images B, C, & D).

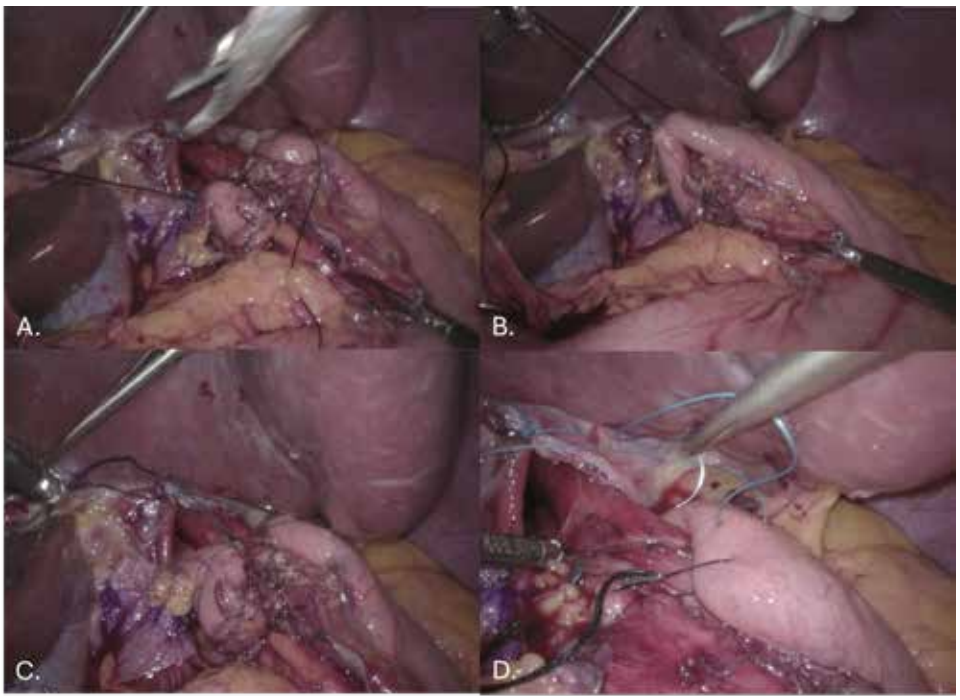


Figure 16: In these cases, I usually perform a Toupet fundoplication. I tend to place a stay suture to tether the two edges of the stomach together, which holds them in position, thereby simplifying the suturing process (Images A & B). The Toupet fundoplication is carried out by placing apical sutures first (Image C & D). A total of three sutures are used on each side, which results in a 270 degree partial fundoplication. The original stay suture is subsequently removed.

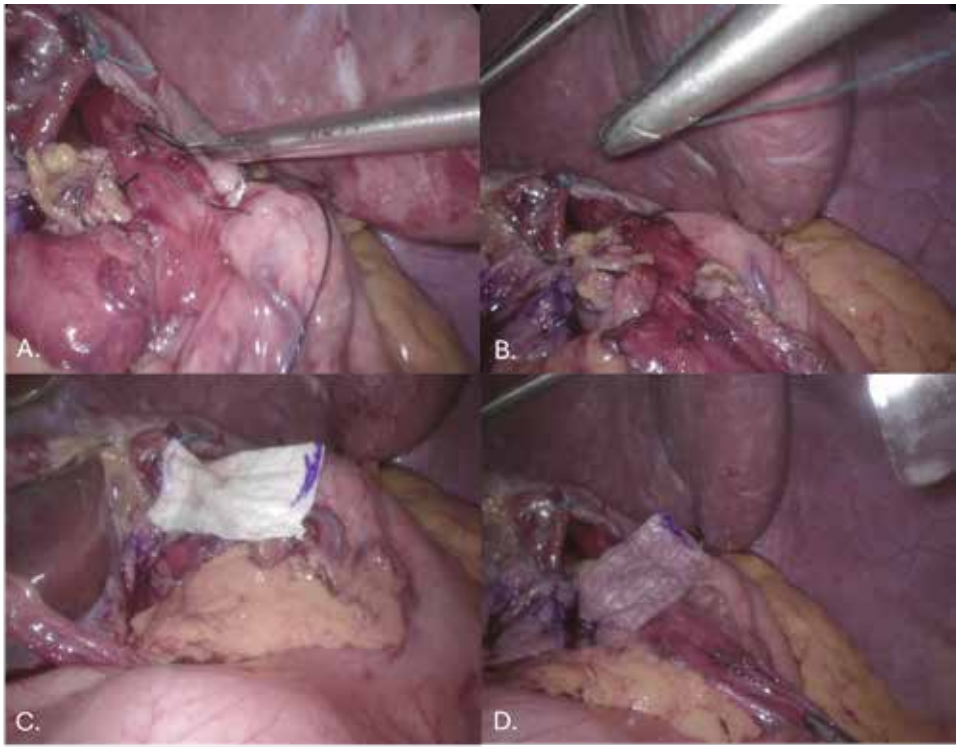


Figure 17: I then reinforce the fundoplication (Images A and B) with biologic mesh, which simply covers it in an effort to promote permanent scarring of the newly created fundoplication into this permanent position (Image C & D).

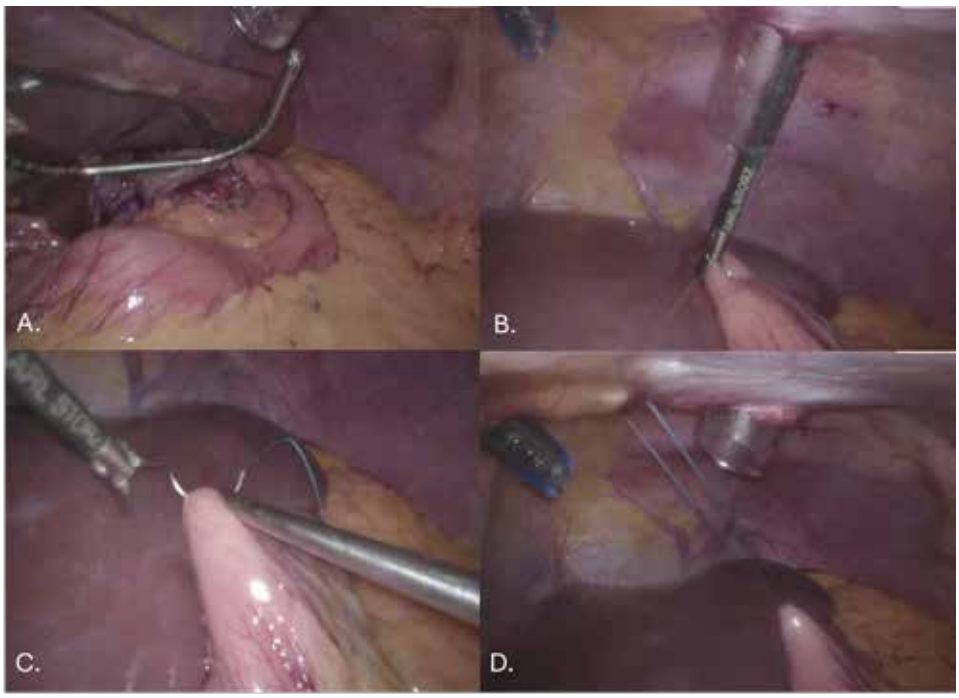


Figure 18: Thereafter the left lobe of liver is allowed to drop back into position (Image A) and a gastropexy is carried out trying to approximate the normal position of the fundus in relationship to the anterior abdominal wall in an effort to prevent it from re-herniating (Images B, C, & D).

Discussion:

Hiatal hernia is a common diagnosis that can range from asymptomatic, incidentally found Type 1 sliding hernias to acutely symptomatic and life threatening large Type 4, with part or all of the stomach and one or more other intra-abdominal organs herniated into the mediastinum with or without gastric volvulus (Figure 1).

If surgical repair is indicated, we favor the laparoscopic approach. The open approach has been replaced in a majority of cases due to longer length of stay, slower recovery, and higher complication rates[13–15]. The robotic-assisted approach is an emerging technology that offers surgeons greater degrees of freedom and improved vision in the operative field, and has similar outcomes to laparoscopic surgery. However, studies on the cost and rates of conversion to open surgery are mixed[16,17]. Therefore, we adhere to the current gold standard of laparoscopic repair.

The laparoscopic hiatal hernia repair can be a challenging operation in patients with a large hernia or gastric volvulus. In order to minimize chances of recurrence in all cases, including the especially challenging presentations, we advocate meticulous technique and a well-defined strategy to be followed in every case. This includes thorough dissection and excision of the hernia sac to facilitate reduction of the hernia contents, ensuring sufficient esophageal length, secure closure of the crura with adequate reinforcement, fundoplication and gastropexy. With these surgical principles in mind, the surgeon is set up for successful repair with a low recurrence.

Conclusion:

Repair of para-esophageal hernia or gastric volvulus can be extremely difficult and requires a high level of laparoscopic skill. A clear strategy is required to generate excellent and consistent results. Meticulous attention to the surgical principles outlined is required to ensure excellent outcomes and minimize recurrence.

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